Electrical World and Engineer

THE CONSOLIDATION OF "THE ELECTRICAL WORLD" AND "THE ELECTRICAL ENGINEER."

VOL. XXXIV. NEW YORK, SATURDAY, AUGUST 19, 1899. No. 8.

PUBLISHED EVERY SATURDAY BY

ELECTRICAL WORLD AND ENGINEER

(INCORPORATED.)

120 LIBERTY STREET, NEW YORK.

TELEPHONE CALL: 4044 CORTLANDT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

CHICAGO OFFICE, - - - - - - - - 936 Monadnock Block.
PHILADELPHIA OFFICE, - - - - - - 929 Chestnut Street.

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Change in advertisements intended for a particular issue should reach the office of the ELECTRICAL WORLD AND ENGINEER on or before MONDAY morning of the week of issue. New advertisements can be received up to 10 A. M. of Tuesday of the week of issue.

TERMS OF SUBSCRIPTION.

United States, Canada or Mexico . . . . . per year, $3.00
Foreign Countries within the Postal Union, ... 6.00
Single Copies, ...10
In requesting your address changed give OLD as well as new address.

(Entered as second-class mail matter at the New York Post Office.)

NEW YORK, SATURDAY, AUGUST 19, 1899.

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COMMEMORATING EVENTS.

Last week a bronze tablet was placed on one of the buildings in this city to commemorate the fact that it was the first example here of the modern steel construction now so marked a feature of architecture in American cities. The idea is praiseworthy, and we would like to see it extended. Why should not such a tablet be put on the first house in New York to use gas—if the house still exists? Why should not the first building in which the telegraph was used, or that in which the telephone first spoke, be similarly identified and adorned? The University of New York where Prof. Morse worked has gone, but it has a successor, and there is a tablet on the house in which Morse lived. We should be glad to see a tablet on the house in which the first incandescent lamps were burned, or that in which the first electric annunciators rang. These are events all worthy of recognition and commemoration at the hands of a public for which electricity has done so much.

MUNICIPAL OBSTRUCTION.

Some of the recent evidence before the Mazet Investigating Committee in New York throws light upon the methods of the municipal authorities to whom some people would intrust the control of a large number of public services, on the ground that they would be managed and operated with efficiency and economy. Commissioner Kearny, who has charge of the lighting, testified that his work with regard to wires and lighting was wholly obstructed and even paralyzed because the Municipal Assembly had neglected for a year and a half to approve the rules and regulations he had drawn up. As a matter of fact, New York City is now burning a large number of gas and electric lights without any contract or any fixed price, and nobody knows when this unbusinesslike state of affairs will come to an end. Mr. Kearny is also hampered in dealing with wire problems, and that part of his work is in a chaotic state. The Municipal Assembly treats its duties in these respects as it does others, and yet there are advocates for loading on such a body the ownership of street railways, lighting plants and a telephone system. The mere suggestion is ridiculous with such a state of affairs as now prevails, to show what would be the inevitable results. At this very moment, the shadow of crime hangs over the Assembly, some of whose members are now specifically accused of corruption in connection with the obstruction offered to proposed bond issues, their alleged object being to get the persons who would receive the bonds in payment for work to "put up," in order to insure the passage of the bond issue. To such persons would be entrusted the municipal underground road and all that thereto pertained.

CANALS AND WATERWAYS.

It is surely a little bit curious that at a time when many of our economists are holding that the day of the State Canal is past, the Emperor William of Germany should be announcing his inflexible determination to push new canal work to the utmost of his ability. Mr. Abram S. Hewitt takes quite a pessimistic view of the Erie Canal outlook and doubts whether there is any "justification for the

expenditure of any considerable sum of money by the people of this state for the enlargement of the existing canals;" while he admits virtually that without such improvements the canals are likely to become more and more of a burden on the taxpayer. On the contrary, the Emperor William, in opening the Dortmund-Ems canal, says: "The growing needs of the country demand more extended and easier modes of communication. The exchange of goods in bulk in the interior can only be effected by waterways."

It would indeed seem that a career of usefulness still lies before the Erie and other canals, and one must agree with Mr. Charles A. Schieren that the canals have a most important regulating function as to traffic rates and are also valuable as means of intercommunication for heavy material. But it may be questioned whether here or in Germany, or in any other canalized country, the full benefits can come until the canal towage is done in some electrical manner. All new canal work should be shaped now to that end.

THE METRIC SYSTEM.

An English contemporary remarks that there is little doubt the day of the metric system for Great Britain is dawning, and that future historians may seize upon the present method of confusion as a striking instance of the conservatism of the English people. Any progress toward the adoption in England of the metric system will be hailed by the friends of the system on this side of the water, for notwithstanding the prestige which our adoption of it would give our commerce, there appears little hope of such initiative. Our contemporary adds that the London School Board has taken a practical step in preparation of the day when the English system will be consigned to the list of curious survivals in an enlightened period of the crudities of early stage of development—the action consisting in the adoption of a definite curriculum of instruction for each grade of schools.

It is most sincerely to be hoped, however, that when in this country similar action is taken by educators in view of the probable future legal adoption of the metric system, some discretion will be exercised in the method of its teaching. The undeniable unpopularity of the metric system among our people at large is without doubt due to a great extent to recollections in after life of the formidable looking tables which in youth while at school were presented to them under the label "The Metric System." With strange looking names followed by long decimal equivalents, and one end or the other of the table, or sometimes both, corresponding to quantities beyond the range of childish comprehension; with tables given as a whole without any indication as to the weights and measures actually coming within the range of ordinary use; with the myriagramme placed on a plane in this respect with the kilogramme, the decametre with the centimetre, and the square and cubic metre masked under the names centiare and decistere, words unknown in France outside of books—such a system of teaching would doom the metric system in the country of its birth if its survival depended upon the vote of the school boy grown to man's estate.

In common school teaching it would appear to be merely necessary to give the pupil a definite idea of the length of the kilometre, metre, centimetre and millimetre; the weight of a gramme, kilogramme and tonne; the surface of a hectare; the contents of a litre and hectolitre—in other words, impart a knowledge of the metric quantities in actual daily use where the system prevails. As a parallel course of instruction, the significance of the prefixes could be taught, but with the mind unperplexed by consideration of the corresponding comparative values if those are not of practical moment. In any event, the pupil should not be required to memorize a series of tables, most of the terms of which are not employed even in France, and none having a meaning if what it represents cannot be taught objectively or by comparison with English equivalents within the range of the pupil's comprehension. Such further terms as may be used in science can be left to a later day, when their significance will be made clear by acquaintance with the quantities to which they refer.

THE GAS ENGINE AS A MOTIVE POWER.

Gas engines seem destined to play a prominent part in the power development of the future. There are two sides to the question. First, the relative competition between gas engines and steam engines in large central stations for electrical distribution of power; and, second, the relative competition between gas engines and electric motors in isolated plants. As regards the latter, we do not think that the present outlook threatens the electric motor to any serious extent. The gas engine may supplant the steam engine in isolated plants, as in factories, but the simplicity, steadiness, cleanliness and coolness of the electric motor places it at a considerable distance beyond all rivals for the general purposes of power distribution.

In the case of isolated lighting plants, it is quite likely that gas engines may supplant steam engines in many cases where the exhaust steam has no immediate application or value. In the first place, large gas engines promise to be made, in the near future, capable of delivering steady power on an average consumption of one pound of coal per horse-power at the shaft; and, in the second place, the auxiliary plant of a gas engine is very simple by comparison with the auxiliary plant of a steam engine, in which numerous devices are employed to economize the waste of energy. Until recently, a serious objection to the gas engine for electric lighting power has been in the unsteadiness of driving. But recent developments seem to prove that the gas engine can drive dynamos almost, if not quite, as steadily as good steam engines. The fundamental advantage of the gas engine lies in the fact that the range of temperatures which it can utilize in its cylinders is greater than the range of temperature which a steam engine can employ, thereby enabling a greater efficiency to be obtained. A large gas power plant calls for fuel gas manufactured in the immediate neighborhood, while a small gas power plant calls for piped gas which may be manufactured at a considerable distance. The demand for water in a gas plant is limited to that needed for cooling purposes, and when necessary can be made comparatively small, while the water consumed in a steam plant can only be limited in like manner by the use of comparatively costly apparatus.

While the prospect for the introduction of the small gas engine seems to be generally bright, yet it is brighter at the present time in Europe than in this country, owing to the fact that there the relative cost of illuminating gas to coal is less than it is on the average in this country. For this reason, we may expect to see a more rapid initial development of the small gas engine for power purposes on the other side of the Atlantic.

POPULARIZATION OF SCIENCE.

One of the most noticeable features of the present age is the rapidity with which the practical application of a scientific principle follows upon the heels of its discovery. In the days that were, the laboratory of the physicist was located upon some mountain top or desert plain, far from the factory and counting house. Now the laboratory is surrounded by the factories, and in the time that is to come, the two classes of buildings will, perhaps, not be capable of distinction. The reason for this mutual approach of science and utilization is not that the great world of men appreciate science any more than they did of yore, but because science is necessary for the support of the race. Civilization is so situated that in the struggle for existence the scientific methods are the only ones which will

competitively succeed. Scientific farming on a large scale must inevitably send unscientific farmers to the wall. Scientific bridge and house building must in the long run outstrip careless, unintelligent and unscientific construction. As matters stand even now, the race would be nearly at starvation level but for the achievements of engineering. In this sense, science is very properly defined as nothing but crystallized common sense. It follows, therefore, that the men who design and the men who construct, must be more and more distinctively applied scientists in each succeeding generation. This is very noticeable in the present age. The engineers of to-day are essentially applied scientists, and without applied science, the machinery, the tools and the structures of the day would be impossible. In every branch of industry these tools and machines are coming into more general and extensive use, and all of the men who handle them are necessarily compelled to learn something of mechanics. Under these circumstances, the knowledge of mechanism infuses itself into the whole mass of the community, and carries with it a certain amount of the knowledge of applied science.

What is taking place particularly in mechanics, is also taking place to a more limited extent in electricity. People are compelled to rely more and more completely upon electric mechanisms of all kinds, and no matter how careless as to the nature of these mechanisms they may be, they are compelled to learn something about applied electricity. On the other hand, the more intelligent members of the community become directly interested in the subject and study it to a greater or less extent, so that the more electrical applications multiply in number and utility, the more general becomes the diffusion of electrical applied science; first, in those few whose business it is to design, construct and operate such apparatus; secondly, in those many who are intelligently interested in the subject without being connected with it; and, thirdly, the great majority who are not interested in the subject, but who are compelled perforce to learn some little about it by constant association of object lessons and ideas. Do what we may, and believe what we may, we are compelled by the logic of events to accept the conclusion that the measure of the material distance which separates humanity from the brute creation lies in the power which they are capable of exerting over the crude environment of the material universe, as determined by the extent and influence of the applied sciences, and of applied electricity among them.

THE CONNECTIONS OF WATTMETERS ON POLYPHASE CIRCUITS.

The growing popularity of accounting by means of integrating wattmeters, for the amount of power delivered or absorbed by each of the many electrical machines and circuits connected to a network, combined with the rapidly increasing use of polyphase systems, has occasioned a demand—which has so far been very poorly met—for satisfactory polyphase meters. The integrating motor-meter of either the commutator or induction type, which has been brought to such a high state of perfection for single-phase alternating current work, is not readily adapted to polyphase working. If the circuits are unbalanced (and this is generally the case), at least two meters are required, while if the balancing is sufficiently close to make the reading of one meter reliable, its proper connection is quite too complicated to be entrusted to the ordinary meter man. What is needed is a single meter, the motor of which shall be acted upon by all legs of the polyphase circuit; any unbalancing of the load being automatically allowed for in the polyphase meter-motor driving a single recording mechanism. Such a meter on low-tension circuits would require no independent current, potential or Y-box connections, the supply circuit entering at one side and leaving at the other as in the case of consumer's ordinary single-phase meters. Considering the simplicity of a polyphase induction motor as compared with a single-phase induction motor, it would seem that the design of such a meter would be an easy problem.

Taking meters as we have them, however—that is, single-phase—and applying them to polyphase circuits, two separate meters are required for the accurate measurement of either two or three-phase power if the different phases are unequally loaded. Two meters may be made to very simply measure the loads on three-phase circuits by the principle outlined in the first two paragraphs of the article by Aug. J. Bowie, Jr., on another page of this issue on the subject of the "Measurement of Power in Polyphase Systems." Under this principle two legs of the circuit are carried through the series coils of the two meters respectively, the shunt coils being connected between the corresponding legs and the third leg of the system. In case the load is non-inductive, the series component of one meter lags behind the shunt component, while that of the other meter leads. In case the load becomes inductive, one meter gains somewhat while the other loses a greater amount of torque. Thus on an inductive load two meters connected in this way never register alike, whether the circuit is balanced or not.

Another and preferable method of connecting two meters on the three-phase system, and one frequently used in practice, is to so combine the shunt and series transformers supplying the coils of the meters as to make a sort of Scott connection from three phases to two phases, the two meters working in the two phases of the secondary of such a transformation. By this means the current in the series coil of each meter is brought into phase with that in the corresponding shunt coil, so that the meters register alike on either inductive or non-inductive loads so long as the circuit is balanced, and the difference between the readings of the two meters gives an indication of the unbalancing of the circuit.

It is customary to assume that the power entering a three-phase motor is equally divided between the three phases; this assumption arising probably from the fact that it is impossible by any manipulation of the load or excitation of the motor, if it be synchronous, to unbalance the distribution. This may, however, be far from the case if the same circuit supplies other loads which are unbalanced. If, for example, one circuit supplies both lights and a motor, and the lighting load is not perfectly balanced, the motor—whether it be induction of synchronous—acts as a compensator by taking more power from the lightly loaded phases and less power from the more heavily loaded phase or phases. In case the lighting load is exceptionally heavy and distant from the generator, the motor may even take in all its power from the other phases and return some to the heavily loaded phase. Thus with certain meter connections the motor may appear to be generating power, while with others the record of power absorbed might be twice or more the proper value. For this reason the use of single meters on such circuits is to be regarded with suspicion.

A customary method of obtaining the proper phase relation for the potential coils of a meter working on a three-phase circuit is by means of what is known as the "Y-box," some of the evils of which are pointed out in the article above referred to. In one large central station recently constructed the number of meters—indicating, integrating and in some cases recording—required for measuring the power delivered by the generators and absorbed by various electrical auxiliaries, was so great that a single group of instrument transformers was installed, and bus bars were run to carry the current from these instrument transformers to the potential coils of the large number of meters scattered over the switchboard. A further improvement that suggests itself in the same direction is the elimination of the Y-boxes of each separate instrument and the substitution therefor of one common Y-box, with bus bars direct to the potential coils. Even this Y-box, or at least the non-inductive resistance portion of it, could be done away with by the use of Y-connected instrument transformers.

Steam Railroad Data of the United States.

According to a compilation made by the Inter-State Commerce Commission, there were 36,234 railroad locomotives in the United States last year. This number is larger by 248 than the previous year. Of these 9956 were classed as passenger locomotives, 20,627 as freight locomotives, and 5234 as switching locomotives, the remainder being unclassified. The total number of cars of all classes reported in the service of the railroads was 1,326,174, being an increase of 28,694. Of this large number 33,595 were used in passenger service, 1,248,826 in the freight service, and 43,753 in the service of the railroads themselves. There were used in the United States last year 28 locomotives and 718 cars per hundred miles of line.

In the country at large 50,328 passengers were carried for each passenger locomotive, and 62,614 tons of freight were hauled for each freight locomotive. The number of persons employed by the railroads in this country last year was 874,558, which is equivalent to 474 employees per hundred miles of line. As compared with the number of employees for the previous year, there was an increase of 51,082.

The amount of railway capital outstanding on June 30, 1898, not including current liabilities in the term, was $10,818,554,031. This amount assigned to a mileage basis represents a capital of $60,343 per mile of line. It is stated that the aggregate number of passengers carried on all of the railroads in the United States for the year ended June 30, 1898, was 501,066,687. The gross earnings of the railroads of the United States for the fiscal year ended June 30, 1898, were $1,247,325,621, being greater by $125,235,848 than for the previous year.

The Commercial Cable and Cuba.

A voluminous opinion by ex-Senator George F. Edmunds was forwarded last week to Secretary of War Root as to the right of the War Department to use military force to prevent the Commercial Cable Company from landing on its own property in Cuba at the Cuban end of its proposed cable line between that island and the United States. General Brooke having been thus directed to prevent the Commercial Cable Company of Cuba from landing in Cuba, the company addressed itself to the Washington authorities. Protest was made against the contention of the International Ocean Telegraph Company that its exclusive rights were assured for forty years under royal decree and order of the Queen of Spain dated 1866 and 1867. The Commercial Company held that it should not be prevented by military force from landing its cable in Cuba, setting up that if permitted to land free of restraint the existing company might have recourse by the usual methods of injunction against its operation. The Commercial Company, however, was in the angle between threatened prevention by military force of its landing on the one side and on the other by lack of ground on which it might take legal initiative.

At this juncture Mr. William W. Cook, general counsel to the Commercial Company, invoked the opinion of ex-Senator Edmunds. Mr. Edmunds holds with Attorney General Griggs that durable grants in the island ought not to be made, as they might embarrass the expected new Government of Cuba, when it shall come into occupation, but he declares that establishing a telegraph wire on the private property of the new company and extending it to the United States cannot possibly infringe this principle and policy. He expresses the view that while the Spanish grant of 1866 ran for forty years its exclusive rights were to be coequal with exclusive rights of the existing line in the United States, and these, Mr. Edmunds holds, expired after fourteen years, or in 1880. He holds that forcible prevention of the new company's landing in Cuba by the military can be redressed by suit against those who permit or direct such obstruction, from the private soldier up to the Secretary of War. In conclusion Mr. Edmunds holds that the exclusive rights of the operating company urged under the Spanish grant cannot be maintained in a court of justice, and he adds:

"I advise, therefore, that you lay the whole matter before the President, who, I am confident, will be willing in a case of so much general public interest to hear you and to give the matter his personal consideration, and that he will direct such steps to be taken as will enable you to proceed with the cable without committing the Government to any concession in your favor or to any action which will in effect maintain the present monopoly, or else that the President will direct a suit to be brought to determine the matter as I have above suggested." This document is now in the hands of the War Department, and it is said that the matter will not be allowed to drop until a determined effort has been made to secure equal rights.

Data As to Electrical Wires and Distribution in Boston.

In the last issue of the ELECTRICAL WORLD AND ENGINEER quotations were made from the report of Mr. T. W. Flood, commissioner of wires of the city of Boston, as to the work done by his department. Some further data furnished us is also interesting. It appears that since the department began its work, it has removed or superintended the removal of about 5836 miles of overhead wire and cable. Of this no less than 3502 miles could be classed as dead wire and abandoned, and nearly all of it had to be cleared out by the department.

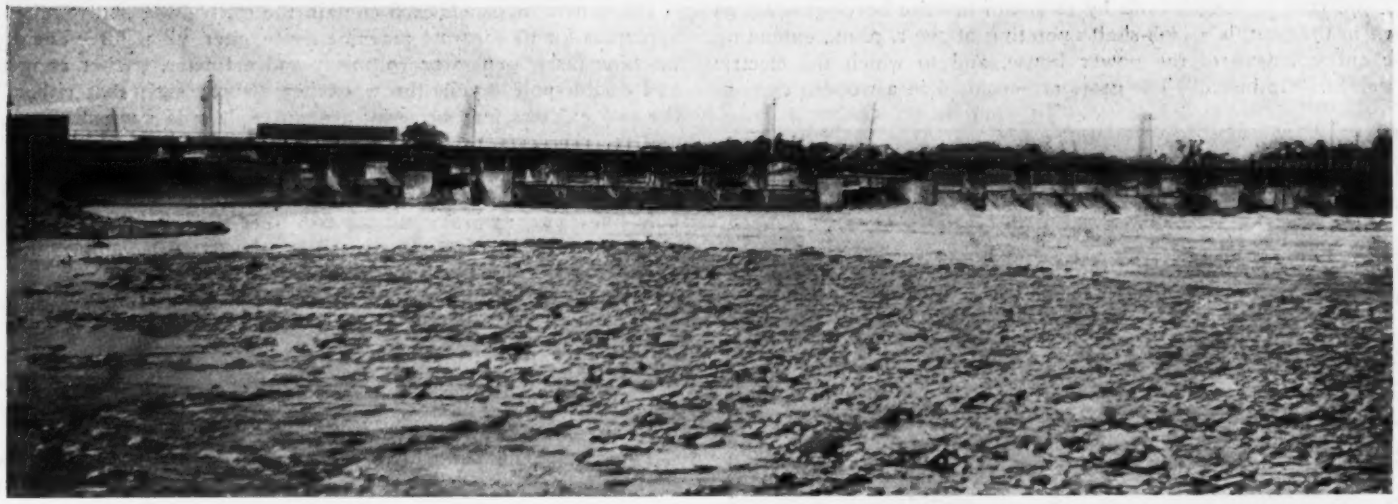
Another part of Mr. Flood's work is that of inspecting apparatus, and the number of defects discovered and corrected has been 18,984. It would be interesting to determine how many fires were thus prevented.

The amount of underground work in Boston is given as follows: Feet of conduit, 726,997; feet of duct, 3,469,011; feet of cable, 5,427,482; feet of single conductor in cables, 167,751,793; number of service connections, 7313; number of manholes, 4563; number of feet Edison tube, 395,909; number feet of single conductor in same, 1,442,339; number of distribution boxes, 374.

The total rated horse-power of boilers in use for the production of electrical energy in the city of Boston is 90,382; of engines, 66,774; total capacity of dynamos in incandescent lamps, 424,443; in arc lamps, 13,094; of electric motors in operation, 7070; total horse-power of motors, 84,002; number of generating stations, 29; number of isolated or private plants, 195.

Rapid Growth in the Use of the Telephone in New York.

Many people take more note of progress abroad than they do of that which goes on right under their own noses. One frequently reads of things that are better done in London, Paris or Berlin than they are in New York. A very moderate amount of inquiry and observation would convince the writers of such remarks that in many branches of modern progress New York leads the large cities of the world. But a few months ago one of the leading New York dailies contained an editorial note to the effect that the French Government, when it took over the Paris telephone system some years ago, reduced the rate of subscription, and that during the period since the transfer there had been a large increase in subscribers. Why, asked the paper in question, could not a company do the same thing? Had the writer of that note made any inquiry as to the progress of the telephone in New York during recent years he would not have asked that question. As a matter of fact the telephone system of New York has grown more rapidly than any other system in the world, and the rates in New York have been reduced more effectively than in any other large city. In 1895, when the first message rate scale was introduced in New York, there were only a little over 10,000 telephone stations. At the present time there are nearly 33,000 stations, showing that the system has more than trebled in the short term of five years. New York, the old city, now the Boroughs of Manhattan and the Bronx, has more telephones in use than London and Paris together, and at the present rate of increase bids fair in a very few years to have more than London, Paris and Berlin combined. Those cities have a combined population of nearly ten millions, while the population of Manhattan and the Bronx is not more than about two millions. This shows that the use of the telephone is far more general here than in the big European cities. The rates in New York have been reduced so much in the past few years that the cost of the service in New York is not, on the average, appreciably greater than in London and Paris, and, as a matter of fact, the minimum rate in New York, which meets the wants of a large number of users of the service, is actually less than the minimum rate in London and in Paris.



Canadian Water Power Electrical Plants—VIII.

THREE-PHASE TRANSMISSION AT TRENTON, ONT.

By E. M. Archibald.

THE Trent River joining Rice Lake, one of the great chain of lakes in the interior, and comparatively unknown part of Ontario, and the Bay of Quinte, on Lake Ontario, some 30 miles long, is one of the most fruitful sources of water power in Canada. Although the volume of water is not unlimited, yet it is quite large, besides having the additional and most important advantage of possessing great uniformity or steadiness of flow, being indeed ranked, according to the Hydrographic Survey, the third river in America in that respect.

Within a distance of nine miles of Trenton, a small town of 4,000 inhabitants, situated on the Bay of Quinte, the elevation of the river rises to no less than 110 feet, and there are many sites capable of being utilized for water power; as yet, however, there are but a few developments, viz., two pulp mills, a grist mill, a sash and door factory and an electric plant, all operated by the water power. This latter may prove of some interest to the electrical public, as it now takes its place in the rank of our long-distance transmission plants.

Some ten or twelve years ago the town of Trenton, with commendable enterprise, constructed a dam, and head race on the Trent River, two miles above the town, and made proposals to manufacturers to locate there and utilized the cheap water power. Like many other plausible objects, it came to naught, and the developed power remained inoperative until June 1, 1896, when the Trenton Electric Company turned on the power to revolve the turbines and generate electrical energy. This company was organized in August, 1895, and, after much dickering in which the town showed a very grasping spirit, terms were finally arranged for the lease of this power.

In finding a market for their electrical power, the company proposed to transmit to Belleville, a town of 11,000 inhabitants, 12 miles distant, the demand in Trenton being very limited; but were forbidden by the town to dispose of any power outside of Trenton itself. Terms were finally amicably settled, the company obtaining the privilege desired, and power will be transmitted to Belleville in a very short period. So much for the history; now let us turn to the power development and equipment.

THE DAM, HEAD RACE, ETC.

The dam (shown at head of this page), some 800 feet long, is built of and is known as a timber dam, in the form of an equalateral triangle, the base, 60 feet wide, being solidly bolted to the bed rock, and the apex of the triangle cut off to form a roadway. Several sluices have been left in the dam to permit the log "drives" descending the river to pass through. These may be closed when necessary by dropping heavy timbers in a space allotted for that particular purpose. The crest of the dam is quite wide, and high above the water level, a private railway crossing the river on it.

There are power developments on each side of the river at this point, a sash and door factory on one side and the electric plant on the other.

The head race for the latter is 800 feet long, and varies in width, as may be seen in the plan (Fig. 3), the different widths being 70, 60, 50 and 40 feet respectively. A diagonal boom is placed outside the entrance to catch all rubbish, etc., and carry it off by means of a waste-gate in the dam. There are three timber bulkheads at the entrance, between which are placed head gates, which may be closed, when necessary, by means of windlasses placed at the top. The sides of the head race are built of heavy timber uprights bolted to the bed rock, supported by diagonal timbers in the head race, also bolted to the bed rock, and faced with three-inch plank; as an extra support, numerous iron rods span the head race, and hold the two sides together.

At the lower end of the head race there is an iron rack placed diagonally to prevent any rubbish, floating ice, etc., from entering the penstock and injuring the wheels, a small waste gate opened or closed at will being placed here for the purpose of disposing of all this refuse.

The normal head of water is 12 feet, but this is sometimes increased to 15 feet during high water. There are two wooden penstocks, each 14 feet in diameter and 34 feet long, containing one turbine each.

The tail race, into which the water falls, after passing through the wheels, is quite short, the water then re-entering the river. By means of a small dam, the level of the tail race water is maintained 10 inches above the outlet of the draught tubes.

On account of insufficient provision having been made, anchor ice often forms on the rocky bottom at the shallow tail race outlet, and causes backwater, thus diminishing the available head and partially drowning the turbines. Operations will, however, shortly be commenced to remedy this evil.

Last winter trouble was also experienced with ice in the head race. This was caused by the coffer dam at the entrance never having been entirely removed, its crest indeed remaining within a few feet of the surface. This, of course, diminished the inlet area, and produced a great draught in the head race, so that both frazil and anchor ice would form at times of a sudden fall of temperature. This will also be remedied by the entire removal of the old coffer dam.

POWER HOUSE.

The present power house, 80 feet long by 40 feet broad, is a two-story wooden building encased in iron sheathing, its foundations resting on the bed rock. The generator foundations are of concrete, 20 feet deep, and the standards for the jack-shafting also rest on concrete piers of the same depth.

Another power house is now in course of construction, for developing more power, situated 40 feet above the present building. This will be the same size as the old one, viz., 80 feet long by 40 feet broad, and constructed of wood, covered with iron sheathing, concrete foundations 7 feet high and 7 feet thick resting on the bed rock.

The hydraulic equipment consists of two 58-inch vertical "Boss" turbines capable of developing 150-hp each at 58 revolutions per minute under the normal head of 12 feet, an elevation of these wheels being shown in Fig. 2. They are each hand governed directly in front of the switchboard, the wheel gates being of the "register" type; the entire hydraulic installation was manufactured by the William Hamilton Manufacturing Company, of Peterboro, Ontario, Canada.

Connected to these wheels by means of mortise bevel gearing, as seen in the plan, is a jack-shaft operating at 200 r. p. m., extending the entire length of the power house, and to which the electric generators are belted. The gears are enclosed in a wooden case, as

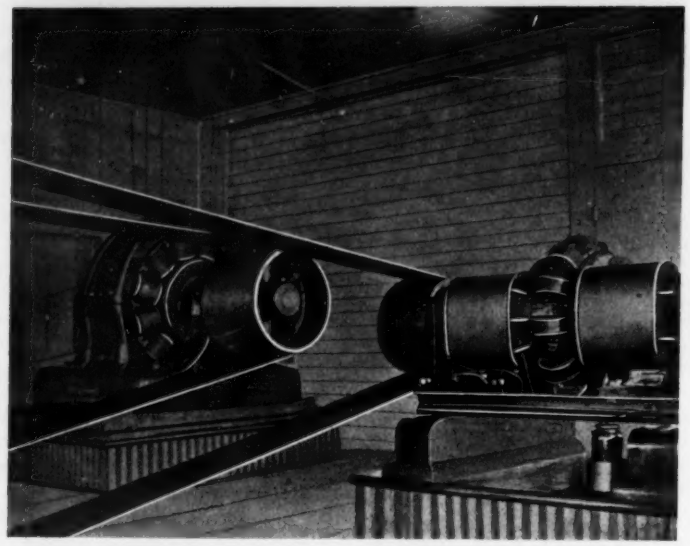
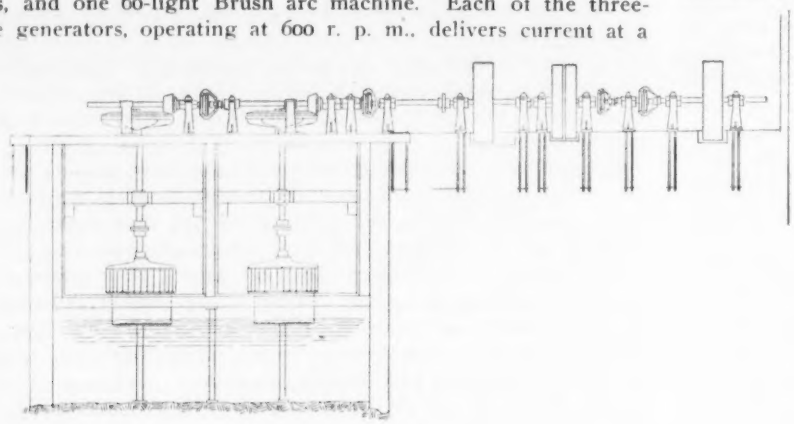


FIG. 1.—INTERIOR OF POWER HOUSE.

are also the driving pulleys, thus eliminating the danger of accidents from that score. This jack-shaft is in several sections connected when necessary by friction clutches, so that any machine may be stopped without affecting the operation of the rest.

The electrical equipment consists of two 150-kw Canadian General Electric three-phase generators, two 6-kw Edison bipolar exciters, and one 60-light Brush arc machine. Each of the three-phase generators, operating at 600 r. p. m., delivers current at a



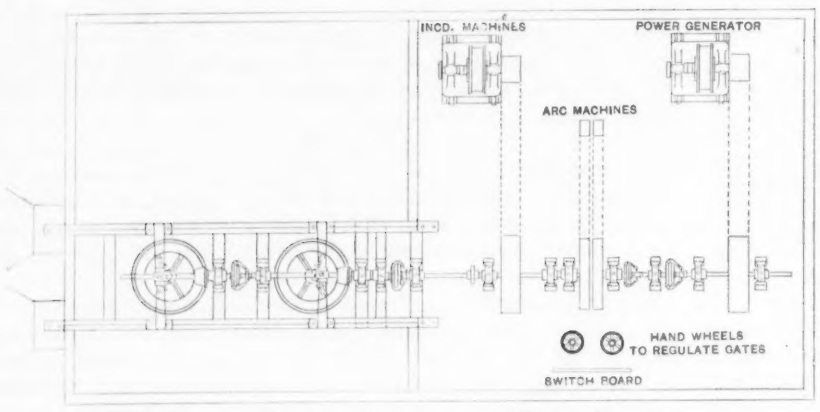


FIG. 2.—PLANS OF FLUME AND OF POWER STATION.

pressure of 2300 volts direct to the line with a frequency of 60 cycles per second. The delta connection is used. The exciters are belted to the generators and run at 1500 revolutions per minute.

SWITCHBOARD.

The switchboard consists of three white marble panels mounted on an angle iron frame, the two outer being the generator panels and the centre one the circuit or feeder panel.

The generator panels each contain the controlling and regulating apparatus for its separate machine and exciter, viz.: Three enclosed machine fuses, generator voltmeter and ammeter, exciter ammeter and double-pole double-throw exciter switch, such that either of the two exciters may be used; a main triple-pole generator switch and the rheostats for the exciter and generator fields, respectively.

The line or circuit panel contains three enclosed fuses, one in each lead, the synchronizing lamps and switch, two main triple-pole line switches providing for two lines though but one is used at present, and a triple-pole switch for the parallel coupling of the generators.

On the rear of the board, which is three feet from the wall, are placed lightning arresters, kicking coils and ground detector.

All the electrical equipment, switchboard, etc., with the exception of the Brush arc machine, which was one of the first of that type to be introduced into Canada, were manufactured and installed by the Canadian General Electric Company, of Peterboro, Ont.

The equipment being installed in the new power house consists of two vertical turbines capable of developing 330-hp each at 65 revolutions per minute under a normal head of 12 feet, connected by mortise bevel gearing to jack-shafts operating at 200 revolutions per minute, to which the two 250-kw three-phase generators will be directly coupled. These generators, delta connected, will generate current at a pressure of 2300 volts with a frequency of 60 cycles per second, and deliver direct to the transmission line running to Belleville, first being "stepped up" to 10,000 volts and retransformed at the Belleville substation to 2000 volts for city distribution.

POLE LINE.

The present pole line is only two miles long, running direct from the power house to the town of Trenton. The poles are of white cedar, 30 feet long, and 7 inches in diameter at the top, embedded 5 feet in the earth and spaced 105 feet apart. Each pole contains three cross arms, the three-phase circuit, only one as yet, being placed on two in the form of a triangle, 12 inches between wires. There is also the arc circuit consisting of two wires, and a telephone circuit, which latter is placed on the lower cross arm, 22 inches belo wthe other, transpoesd every half mile to obviate induction effects.

The line is No. 1 B. & S. weatherproof insulated copper wire securely fastened to ordinary double petticoat deep-grooved glass insulators, the drop being about 5 per cent at full load. Protection against lightning is secured by three sets of lightning arresters, one set at the power house and the others on the poles in the town.

The ordinary overhead construction is used in the town, the four-wire secondary distribution being fed from banks of transformers placed on poles, three transformers in each bank.

The street lamps are the ordinary series arc, forty of which are in use. This circuit is protected from lightning, by Thomson magnetic blow-out lightning arresters, and being placed on the top of the poles, receives the majority of the discharges.

The new transmission line runs in a perfectly straight line across country to Belleville, 12 miles distant, where it enters the substation. The poles are of white cedar 35 feet long, 7 inches in diameter at the top, embedded 5 feet in the ground and spaced 105

feet apart. In very soft ground a wooden box is placed in the hole, and the pole deposited in this and tightly packed with concrete. This produces a splendid foundation.

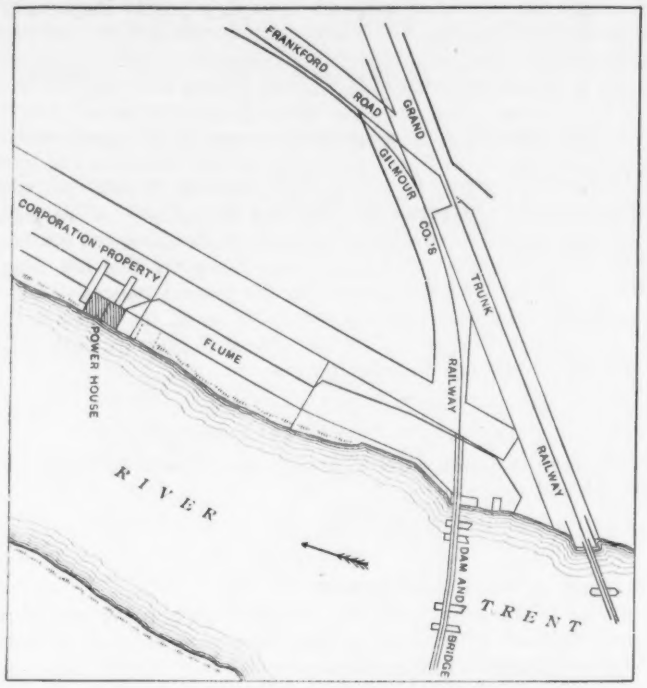


FIG. 3.—MAP OF TRENTON FLECTRIC COMPANY'S PROPERTY.

On each pole there is placed a two and a four pin cross arm, the smaller at the top. The line, only one at present, is No. 6 B. & S. medium drawn bare copper wire placed in the form of an equilateral triangle 22 inches between wires. It is spiraled every 40 poles to prevent mutual induction, each wire on one side of the pole being turned or "corkscrewed" one-third of a revolution to the right; when another line is erected on the other side of the pole,

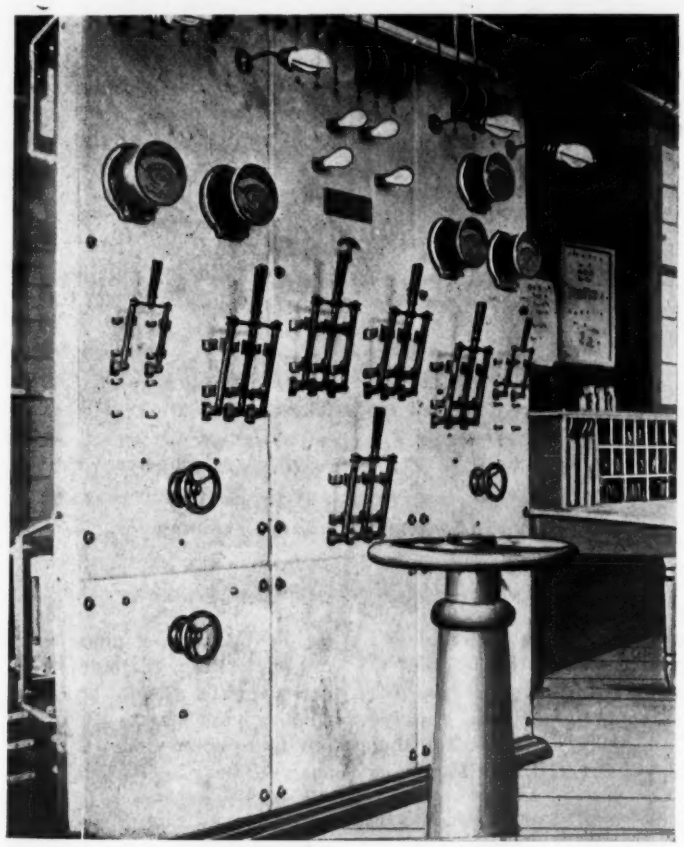


FIG. 4.—SWITCHBOARD IN POWER HOUSE.

spiraling will be proceeded with in the same manner, but turned to the left instead of the right.

The insulators are of porcelain, the triple petticoat type, 6 inches in diameter, and are secured to the cross arms by "Locke" pins having a wooden top and a porcelain pin, through which an iron bolt passes. For lightning protection a barbed wire, grounded at every tenth pole, and secured to the top of the pole by steeples, runs the entire length of the line. The line loss is 10 per cent. at full load.

The substation, a two-story stone building, 60 feet long by 40 feet wide, is situated on the bank of the Moira River in the centre of Belleville. The step-down transformers are to be of the self-cooling type, as no revolving apparatus of any kind is to be used.

In Trenton current is at present supplied by the flat rate, the charges being $4 per lamp per year for stores and hotels, while for residences a sliding scale from $2 to $1.25 per lamp per year is charged, depending on the number of lights installed.

The outlook for the power service is very promising, arrangements now being made to convert a steam road running to a pleasure park four miles from Trenton into an electric road; to supply power to operate the Belleville street railway, and to introduce both the electric light and the electric motor into Belleville to compete with gas and steam. Power is shortly to be supplied to operate the refrigerating and waterworks plants, the contracted rate for which is ⅝ of a cent per hp-hour in summer and 1 cent per hp-hour in winter.

Current will be sold in Belleville entirely by meter, the rate for which is to be about 15 cents per kw-hour, a reduction of 30 per cent. on the present gas rate.

The streets will be lighted by alternating current arc lamps from constant current transformers.

The officers of the Trenton Electric Company, Limited, are: W. H. Pearson, Jr., president; M. M. Thompson, general manager; G. W. Ostrom, secretary, and H. A. Moore, electrical engineer and general superintendent.

Competitive Telephony for New York City.

It is reported that a consolidation of the independent telephone companies of this city is now in progress. It is probable that on Aug. 15 the interests of the People's Telephone Corporation and the New York & Eastern Telephone & Telegraph Company will be pooled with the aim of establishing a successful competitor of the American Bell Telephone system. These two independent companies have had charters for some time, but have never operated owing, it is claimed by the promoters, to the opposition placed in their way by the New York Telephone Company, using the Bell system. By uniting the New York and Eastern and the People's, it is said, the way will be clear to fight the New York Telephone Company, and with this in view a meeting of the stockholders of the People's Corporation was held last week, when plans for absorbing the New York and Eastern were discussed. Another meeting of the stockholders of the People's will be held on Aug. 15, at which time, it is said, the two independent telephone companies will come together, the People's absorbing the New York and Eastern. Mr. A. H. Mildenberg, the general manager of the People's Company, claims to have made contracts with 10,000 subscribers. His company proposes to use the Cole-Martin system now used very successfully by the Detroit independent telephone company.

Darwin R. James is president of the People's Corporation, and Silas B. Dutcher, who is president of the Hamilton Trust Company, of Brooklyn, is treasurer. Mr. Mildenberg, who is general manager of the People's, is also general manager of the New York and Eastern. The charters of these three companies provide for a capital of $5,000,000 each. It is understood that the plan for the consolidation of the two companies provides for the issuing of $1,640,000 of stock by the People's Corporation for the absorption of the New York and Eastern's interests, and the rights to patents of the Citizens' Company.

Psychology of Telegraphy.

Professor W. L. Bryan, of the University of Indiana, and Mr. N. Harter, telegraph superintendent, have been investigating the mental processes in acquiring proficiency in the use of the Morse code. The investigators concluded after a variety of tests that the study of telegraphy is analogous to that of learning to read and of acquiring a foreign language. "There is the same rapid improvement at first, the same dispiriting level just below the ability to understand ordinary conversation, the same rapid ascent into usable knowledge of the language and the same long struggle, seldom completed, before one has freedom in the language."

On the Determination of Current Strength in Three-Pointed Star Resistance Systems.

BY A. E. KENNELLY.

IT is sometimes desirable to compute the current strengths that may flow in the branches of a star three-phase net-work, when the three-phase system is unbalanced, either by unbalancing of the pressure or unbalancing of the loads. It is also sometimes desirable to be able to produce two-phase currents from a three-phase system; or three-phase currents from a two-phase system, for experimental purposes. The means of procedure may be the same in either case, and the process is readily remembered by the aid of a remarkable geometrical proposition associated with it; namely that if any polygonal system of electromotive forces be applied to a star system of impedances; then the centre of pressure of the system corresponds to the centre of gravity of the polygon, itself without mass, but loaded at each vertex with a mass equal to the admittance connected therewith.

We will first consider a continuous-current system. If we have a star connection of three resistances, r_1, r_2, r_3, Fig. 1, and connect their terminals with one or more electromotive forces e_1 between A and B, e_2 between B and C, and e_3 between C and A, then in order to have a balance of pressure around the triangle ABC, it is necessary that $e_1 + e_2 + e_3 = 0$. Otherwise, a current would flow around the triangle. For example, in a simple Edison three-wire system, e_1 may be an impressed pressure of 115 volts, and e_2 an impressed pressure of say 120 volts, while e_3 will be a resulting potential difference of—235 volts, being negative, since its direction is from A negative to C positive, or opposite to the arrow. If we lay off on the line AC, Fig. 2, a length AB of 115 units, and a length BC of 120 units, we have the pressure diagram of the system, since $CA = 235$ units. If we now attach to the line ABC of Fig. 2, imaginary masses equal to the conductances of the three branches; i. e., $\frac{1}{r_2}$ mho at A, $\frac{1}{r_3}$ mho at B and $\frac{1}{r_1}$ mho at C, then the centre of gravity of the system will mark the centre of pressure of the centre O of the star. For example, if $r_1 = 10$ ohms, $r_2 = 5$ ohms and $r_3 = 8$ ohms,

then $\frac{1}{r_1} = 0.1$ mho; $\frac{1}{r_2} = 0.2$ mho; $\frac{1}{r_3} = 0.125$ mho. The centre of gravity of this system is shown in Fig. 3.

From this, we can reconstruct the diagram of "drop of pressure," and the current strengths from these. (See Fig. 4.)

If we consider the case of alternating currents and pressures, the corresponding problem is to determine the centre of gravity of a loaded plane triangle, instead of the centre of gravity of a loaded straight line.

If we consider the two-phase diagram of Fig. 5,

Here $e_1 =$ say 100 volts.
$e_2 =$ j 100 volts.
$e_3 =$ 100 + j 100 volts.

In this case, the pressure e_1 is measured from A to B, the pressure e_2 from B to C, and the pressure e_3 from A to C. If, however, we measure the pressure e_3 from C to A, so as to complete the circuitation of the triangle, we obtain the diagram Fig. 6, where $e_3 = -(100 + j\,100)$.

Now let us connect to the corners of this triangle, the star resistance load of Fig. 1, where

$$r_1 = r_2 = r_3 = 10 \text{ ohm} = 0.1 \text{ mho};$$

then if we load the corners of the triangle of Fig. 6, with the conductance 0.1 mho, we obtain Fig. 7.

The point O will be the centre of gravity of this triangle, as may be found by bisecting any pair of sides and joining the points of bisection with the opposite vertices. If we join the centre of gravity O, with the vertices of the triangle, we obtain the drops of pressure in the triangle, as shown in Fig. 8, and these have the phase and magnitude shown, with respect to the centre of gravity O.

Thus $i_1 r_1 = -\sqrt{\frac{5}{3}} \times 100 \angle 63°.26'$ volts $= -74.5 \angle 63°.26'$ volts.

$i_2 r_2 = \sqrt{\frac{5}{3}} \times 100 \angle 36°.34'$ volts $= 74.5 \angle 36°.34'$ volts.

$i_3 r_3 = -\sqrt{\frac{2}{3}} \times 100 \angle 45°$ volts $= -47.1 \angle 45°$ volts.

If we seek for the currents I_1, I_2 I_3, we divide these drops of pressure by the corresponding resistances and obtain

$I_1 = -\sqrt{\frac{5}{3}} \times 10 \angle 63°26'$ amperes $= -7.45 \angle 63°26'$ amperes.

$I_2 = \sqrt{\frac{5}{3}} \times 10 \angle 36°34'$ amperes $= 7.45 \angle 36°34'$ amperes.

$I_3 = -\sqrt{\frac{2}{3}} \times 10 \angle 45°$ amperes $= -4.71 \angle 45°$ amperes.

In this case the currents I_1 and I_2 differ in phase by 126° 52′, while the other pairs of currents differ in phase by 108° 26′. (Fig. 9.)

If we keep r_1 and r_2 equal, and vary r_3, we find that the centre of gravity of the triangle varies in position along the line BO, Fig 7. When $r_3 = \infty$ that is to say, when only the two resistances r_1 and r_2 are employed, the centre of gravity shifts to d, the mid-point of AC, as shown in Fig. 10. Here the drops of pressure with reference to the mid-point d of the star are

$I_1 r_1 = -70.7 \angle 45°$ volts.
$I_2 r_2 = 70.7 \angle 45°$ volts.

If we change the datum point from d to say A, then we reverse the arrow Ad, and we have

$I_1 r_1 = -70.7 \angle 45°$ volts.
$I_2 r_2 = -70.7 \angle 45°$ volts.

The angle between these pressures is 180°.

If we go to the other extreme, and make $r_3 = 0$, we obtain the pressure diagram of Fig. 11 in which the load at A is 0.1 mho, the load at C is also 0.1 mho, and the load at B is infinity. The centre of gravity is, therefore, at B, and the pressure diagram is, as shown in Fig. 11, $I_1 r_1 = 100$ volts; $I_2 r_2 = -$j volts, with reference to the centre point of B. If the reference point of phase were at A, say, then,

$I_1 r_1 = -100$ volts; $I_2 r_2 = -$ j volts; or simply equal and opposite to the impressed e. m. f.'s e_1 and e_2, respectively. The angle between these pressures is 90°.

At some point between d and B, the centre of gravity of the triangle, or centre of the pressure diagram, will have pressures differing in phase by 120°, or will represent triphase currents. This is found when $r_1 = r_2 = r$ and $r_3 = \frac{r}{1 + \sqrt{3}} = \frac{r}{2.732} = 0.366\ r$.

That is, when r_3 is 36.6% of either of the other two resistances, so that if $r_1 = 10$ ohms, $r_2 = 10$ ohms and $r_3 = 3.66$ ohms.

We then obtain the centre of gravity of the triangle, as shown in Fig. 12, where the ratio of OB to Od is $(\sqrt{3} - 1)$ or 73.2%.

The corresponding pressure diagram is shown in Fig. 12, where

$I_1 r_1 = -100 \sqrt{\frac{2}{3}} \angle 75°$ volts.

$I_2 r_2 = 100 \sqrt{\frac{2}{3}} \angle 15°$ volts.

$I_3 r_3 = -100 \sqrt{\frac{3-1}{\sqrt{6}}} \angle 45°$ volts.

These pressures are dephased 120°. The currents are

$I_1 = -10 \sqrt{\frac{2}{3}} \angle 75° = -8.165 \angle 75°$ amperes.

$I_2 = 10 \sqrt{\frac{2}{3}} \angle 15° = 8.165 \angle 15°$ amperes.

$I_3 = -10 \sqrt{\frac{2}{3}} \angle 45° = -8.165 \angle 45°$ amperes.

These currents are indicated in Fig. 14, in their proper phase relation with respect to the point O. The application, therefore, of a dissymmetrical triphase star to a quarter-phase system produces three equal symmetrical triphase currents in the star.

Conversely, it is evident that if we take three star triphase e. m. fs., OA, OB, OC, Fig. 12, and make OB bear to OC or OA the ratio of $\frac{1}{1+\sqrt{3}}$ or 36.6%, the resulting system of e. m. f.'s A, B, C, will be in quarter-phase relation.

The dissymmetrical star resistance group 1, 1, 0.366 ohm, may therefore be considered as a transformer from two-phase to three-phase currents, but not from two-phase to three-phase pressures, unless the required portions only of the pressures developed are included. Thus, OA, OB, OC, Fig. 13, are pressures in triphase angular relationship, but they are of unequal magnitude.

This transformer is represented in Fig. 15, as having three branch conductances of 1, 1 and 2.732 ohms, respectively. The geometrical properties of this transformer when laid out with its branch resistances making equal angles with each other, are indicated in Fig. 16, which is a right-angled triangle with its hypothenuse of $\sqrt{3}$ units

It is a remarkable fact that the same resistance transformer which converts from two-phase to three-phase also converts from three-phase to two-phase. If we take a symmetrical triphase system of pressures, each of 100 volts, as represented in Fig. 17, and connect the terminals with this transformer, we find the centre of pressure, as before, by taking the equilateral triangle *ABC* of Fig. 17, affixing a mass of 1 to the corner *A* to represent 1 mho, a mass of 1 to the corner *C* to represent one mho, and a mass of 2.732 at the corner *B* to represent 2.732 mhos. Under these conditions, the centre of gravity of the triangle is situated at the point *O*, which is ½ a unit from the middle of the side *AC*. If we connect this point with the corners or vertices of the triangle as in Fig. 18, we obtain as follows the three pressures or drops which occur in the transformer.

$$I_1 r_1 = \frac{-100}{\sqrt{2}} \angle 75^\circ \text{ volts}$$

$$I_2 r_2 = \frac{100}{\sqrt{2}} \angle 15^\circ \text{ volts.}$$

$$I_3 r_3 = \frac{-100}{1+\sqrt{3}} \angle 30^\circ \text{ volts.}$$

The three currents are indicated in Fig. 19, and are, if $r_1 = r_2 = 10$ and $r_3 = 3.66$.

$$I_1 = \frac{-10}{\sqrt{2}} \angle 75^\circ \text{ amperes.}$$

$$I_2 = \frac{10}{\sqrt{2}} \angle 15^\circ \text{ amperes.}$$

$$I_3 = -10 \angle 30^\circ \text{ amperes.}$$

I_1 and I_2 are now in quarter-phase relationship, or in quadrature, while I_3 is midway between them in phase. By this transformer, therefore, a pair of equal two-phase currents are obtainable from the three-phase system.

We have hitherto assumed that the transformer consisted of non-inductive resistances. If, however, the resistances are inductive, the corresponding modification is readily made. It suffices that the three branches shall have admittances in the ratio of 1, 1, and 2.732 as before, while if the power factors of the three branches are equal, the currents will remain in the required two-phase or three-phase relationship, since each current will be rotated through the same angle and will, therefore, preserve the same phase relatively to the other currents.

The same process is applicable for determining the effect of an unbalanced or dissymmetrical system. This is represented in Fig. 20, where the triangle *ABC* represents a triphase system normally of

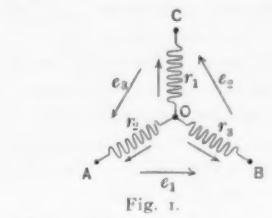


Fig. 1.

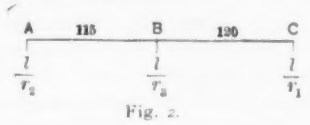


Fig. 2.

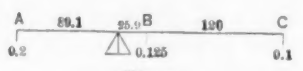


Fig. 3.

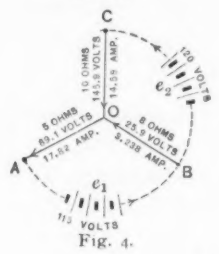


Fig. 4.

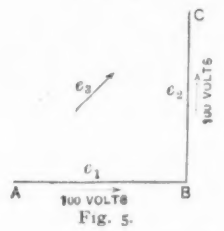


Fig. 5.

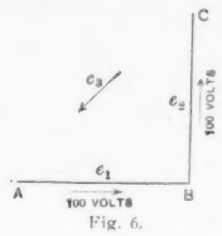


Fig. 6.

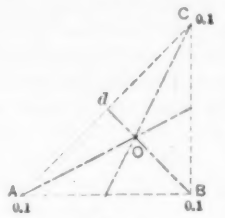


Fig. 7.

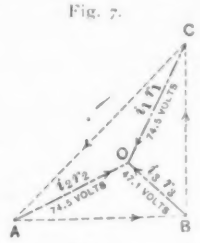


Fig. 8.

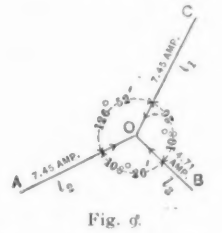


Fig. 9.

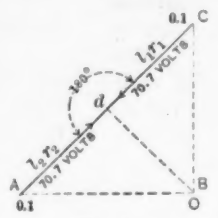


Fig. 10.

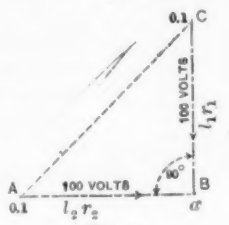


Fig. 11.

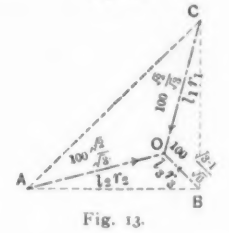


Fig. 12.

Fig. 13.

Fig. 14.

Fig. 15.

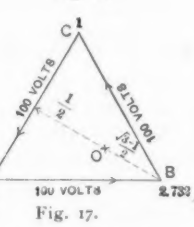


Fig. 16.

Fig. 17.

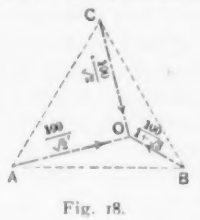


Fig. 18.

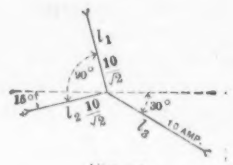


Fig. 19.

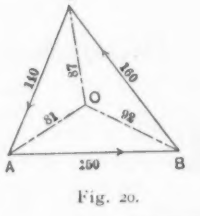


Fig. 20.

FIG. 1.—THREE STAR CONNECTED RESISTANCES.

FIG. 2.—CONTINUOUS CURRENT PRESSURE DIAGRAM.

FIG. 3.—CENTRE OF GRAVITY OF LINE A B C AND CENTRE OF PRESSURE OF SYSTEM.

FIG. 4.—REDUCED PRESSURES AND CURRENTS OF CASE IN FIG. 3.

FIG. 5.—QUARTER-PHASE PRESSURE DIAGRAM.

FIG. 6.—QUARTER-PHASE PRESSURE DIAGRAM WITH CIRCUITAL E. M. FS.

FIG. 7.—LOADED TRIANGLE AND ITS CENTRE OF GRAVITY.

FIG. 8.—PRESSURE DIAGRAM QUARTER-PHASE SYSTEM. EQUAL RESISTANCES.

FIG. 9.—CURRENT DIAGRAM. QUARTER-PHASE SYSTEM. EQUAL RESISTANCES.

FIG. 10.—QUARTER-PHASE SYSTEM.

$r_1 = r_2 = 10 \quad r_3 = \infty$

FIG. 11.—QUARTER-PHASE SYSTEM.

$r_1 = r_2 = 10 \quad r_3 = 0$

FIG. 12.—QUARTER-PHASE SYSTEM.

$$r_3 = \frac{r}{1+53}$$

CENTRE OF GRAVITY.

FIG. 13.—PRESSURE DIAGRAM OF FIG. 12.

FIG. 14.—CURRENT DIAGRAM.

FIG. 15.—TRANSFORMER STAR GROUP.

FIG. 16.—GEOMETRICAL PROPERTIES OF TRANSFORMER GROUP LINES.

FIG. 17.—CENTRE OF GRAVITY AND PRESSURE OF LOADED EQUILATERAL TRIANGLE.

FIG. 18.—PRESSURE DIAGRAM IN STAR TRANSFORMER ON TRIPHASE SYSTEM.

FIG. 19.—CURRENT DIAGRAM IN TRANSFORMER.

FIG. 20.—PRESSURE DIAGRAM OF DISTORTED THREE-PHASE SYSTEM.

150 volts per phase, but distorted to measured e. m. f.'s of 150, 160 and 140 volts, respectively. If equal star resistance loads are applied to this system, we may suppose that the triangle is loaded with equal masses at its three corners and proceed to find the centre of gravity of the triangle, as at O, Fig. 20. The pressure diagram is then found by connecting the vertices with this point. It will be seen that the pressures are

$$I_1 r_1 = -86.9 \angle 81°.9' \text{ volts.}$$
$$I_2 r_2 = 80.7 \angle 32°.08' \text{ volts.}$$
$$I_3 r_3 = -92.3 \angle 27°.43' \text{ volts.}$$

and these are proportional to the current strengths.

The same rules apply to any polygon of e. m. f.'s. If n continuous e. m. f.'s or differences of potential, subject to the law of continuity, be applied between the terminals of a star of n branches, the resulting drops of pressure can be found by drawing a line to scale representing the potential differences, and attaching a load to the line at each junction point, equal to the conductance of the star branch connected thereto. The centre of gravity of the loaded line will give the centre of pressure, and the pressure at the centre of the star.

In the same way, if n alternating multiphase e. m. f.'s be applied between the terminals of a star of n branch impedances, the resulting drops of pressure can be found by drawing the polygon to scale, affixing to each vertex an admittance corresponding to that of the branch connected therewith and finding the centre of gravity of the loaded polygon. This will be the centre of pressure of the system and the systems of currents can then readily be found.

For the case of a triangle, as represented in Fig. 1, let i_1, i_2, i_3 be the vector currents in the three vector branch impedances r_1, r_2, r_3, respectively, produced by vector e. m. fs. e_1, e_2, e_3 indicated by the arrows. Then the three vector pressure drops are

$$i_1 r_1 = \frac{e_3 r_1 r_3 - e_2 r_1 r_2}{r_1 r_2 + r_1 r_3 + r_2 r_3}$$

$$i_2 r_2 = \frac{e_1 r_1 r_2 - e_3 r_2 r_3}{r_1 r_2 + r_1 r_3 + r_2 r_3}$$

$$i_3 r_3 = \frac{e_2 r_2 r_3 - e_1 r_1 r_3}{r_1 r_2 + r_1 r_3 + r_2 r_3}$$

Measurement of Power in Polyphase Systems.

BY AUG. J. BOWIE, JR.

THE general case in the measurement of power in polyphase systems is where there are n wires running out from such a system, and it is desired to find the power which is being delivered by these wires. The only thing which is known in the problem is that the sum of the instantaneous outgoing, or incoming currents, is always zero. From this it follows that the n polyphase wires may be replaced by n-1 single phase circuits, any one of the n wires being regarded as a common return for the current of all the rest. Hence n-1 single phase wattmeters will suffice to measure the power, if connected one on each of the n-1 legs, each having its voltage coil connected from its own leg to the leg without a wattmeter.

The algebraic sum of the readings will give the total power delivered. Care must be taken to have all the wattmeters connected up the same way, since some of the readings may be negative, and hence should be subtracted. Should the wattmeters not read negative power correctly, so that it might be necessary to reverse the connections, such fact should always be taken into account and the proper sign put before the reading. It makes no difference whatever which of the legs is the one without the wattmeter, and absolutely the same method may be used for direct-current, as well as for alternating. While n-1 wattmeters will always read the power, still often less will suffice.

In practice, the following are the cases usually encountered:

I. *Unbalanced Loads.*

1. Two-phase, with four wires. 2. Two-phase, with three wires. 3. Three-phase, with three wires. 4. Three-phase, with four wires.

As ordinarily run in the case of two-phase with four wires, the two phases are electrically independent, and hence two single-phase wattmeters, one for each phase, will suffice. In the other three cases, the general method with n-1 single-phase wattmeters must be used.

II. *Balanced Loads.*—There are three cases, as follows: 5. Two-phase, with four wires. 6. Two-phase, with three wires. 7. Three-phase, with three wires.

One wattmeter can always be arranged so as to read the power in any balanced polyphase system. However, for the reading to be correct it presupposes that the voltages are equal and symmetrical, making the theoretical angles with each other, and that the currents delivered are equal, and lag or lead by equal angles. The loads which are usually regarded as balanced, are motor loads. However, if the voltages are only a few per cent. unequal, and do not make the requisite angles with each other, the motor load may be far from balanced, and any meter readings taken on the assumption that it is balanced may be very much in error. If such an event is possible, the load should be regarded as unbalanced, and should be treated as such.

In the case of two-phase with four wires, one single-phase wattmeter, if placed in one phase, will read one-half of the total power.

In the case of two-phase with three wires, one single-phase wattmeter, if placed in either of the legs not common to the two phases, with its voltage coil connected from its leg to the common leg, will read one-half of the total power—as in the previous case.

In the case of three-phase with three wires, for one wattmeter to suffice, it is necessary to obtain a voltage which is different in phase from any of the three voltages forming the voltage triangle. There are various methods of obtaining this result.

Suppose three non-inductive resistances, R, R', R'', are connected in the form of a star, three ends being connected together, and the

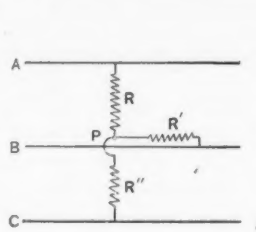


FIG. 1.—DIAGRAM OF CONNECTIONS.

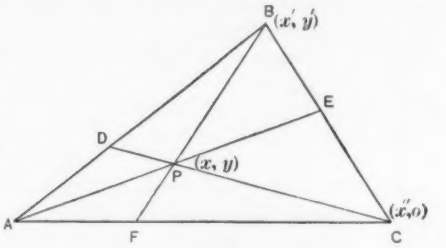


FIG. 2.—VOLTAGE TRIANGLE.

other three connected respectively to the three legs of a three-phase system (see Fig. 1). In the general case suppose the three voltages are unequal, and let the voltage triangle be ABC (Fig. 2).

Let P be the position of the center of the star. In order to find P graphically, divide AB so that $BD/AD = R'/R$. Also divide BC so that $BE/EC = R'/R''$. Draw CD and AE. The point of intersection of these two lines is P, and if BP be drawn, and extended to meet AC at F, then $AF/FC = R/R''$.

The proof is as follows: Take A as origin, and AC as the X axis. The co-ordinates of B are (x', y'), and of C are (x'', O), P being (x, y). The currents in the resistances must be in phase with the lines from P, and they must also vanish, when resolved in any direction.

Current in $BP = BP/R'$. Current in $CP = CP/R''$. Current in $PA = AP/R$. Resolving horizontally:

$$(x' - x)/R' + (x'' - x)/R'' = x/R.$$

Resolving vertically:

$$(y' - y)/R' = y/R + y/R''.$$

If any two of the resistances be regarded as constants, and the other be eliminated, the resulting equation will be of the first degree, and will represent the locus of the point P when the resistance eliminated is a variable. This can easily be seen to be one of the straight lines already drawn in locating P. In the same way, the equations of the other two lines through P can be found, by eliminating respectively, each of the other resistances. If ABC be an equilateral triangle, and R', and R'' be equal, then the current in R will be in the phase desired for the wattmeter, with its current coil in the A leg, and R may be replaced by the voltage coil of the wattmeter.

If $R = R' = R''$, and the load is balanced, then obviously the wattmeter will read just one-third of the total watts delivered; for three equal wattmeters, if placed one in each phase, with the free ends of the voltage coils joined together, will each register the same as the original meter. So that from the geometry of the triangle, the watts delivered $= E I \cos\phi \sqrt{3}$, where E is the voltage between legs, I is the current in each leg, and ϕ is the angle of lag, or lead of the current. If R' is not equal to R, but is equal to R'', the meter will still be correct for balanced load, but its constant must be corrected. It can be easily shown from what has been already proved,

that the factor by which the constant of the meter should be multiplied, is 2 $(I + R'/2R)$. If $R = R' = R''$, as in the case of the ordinary star box, the factor becomes 3.

Another method of obtaining voltage in the proper phase, is to use a compensator across the phase *BC*. The wattmeter is connected with its voltage coil from *A* to the centre of the compensator winding. Here the meter constant must be multiplied by 2.

The most common form of three-phase meter at present in use for measuring motor loads is the one with a star box. It is not an unusual occurrence for one of the coils of the box to burn out, especially when placed on the wrong side of the switch. In this event, the meter will continue to register, since the other coil is alive. If one leg burns out, the meter, if on an induction motor load, will probably go slightly faster than before; but if the other leg burns out, the meter will slow up very much, and in some cases may even run backwards, so that the company will owe the consumer for power which it has furnished. The manager may begin to wonder why the bills are so much smaller than they used to be. The meter man, however, sees that the meter is registering, and that is all that he concerns himself with. Doubtless there are many places where just this thing is happening.

Meters of this description should be frequently tested to see that both halves of the star box are working. All that is necessary is to see that both legs into the box spark when disconnected; or a man can feel them to see whether they are alive.

There are undoubtedly also a great many three-phase meters of this description, which are connected up wrong, the average man who installs them being content if he simply gets the requisite number of wires into the meter, and all wires look alike to him. It will certainly pay managers of three-phase plants, who are not sure that everything is satisfactory, to look up just such matters, and make sure that the meters are registering correctly, especially since mistakes will probably be against the company rather than in its favor.

The Energy of Carbon—II.

By C. J. Reed.

DIRECT METHODS OF TRANSFORMATION.

In a direct or single process we are further limited to the employment of electrolytes which are found in nature, as their artificial preparation would render the process indirect. The electrolytes must be oxygen compounds and capable of supplying oxygen by electro-chemical decomposition to the carbon, otherwise the carbon cannot be rejected in a single operation as an oxide. The electrolytes must be capable of acting directly on the carbon and evolving the final product of oxidation. They must exist in large quantities and be available at a cost little, if any, greater than that of air. The maximum theoretical efficiency of transformation by means of the electrolytes must be not less than the actual obtainable efficiency of a heat engine. This limit we may assume as not less than 20 per cent.

The maximum possible efficiency of any electrolyte, as a transforming agent for liberating chemical energy in the form of electrical energy, is determined when the formation heats of the electrolyte and the products of the electro-chemical reaction are known. There is no relation between this possible efficiency and the availability, cost, or possibility of the supposed reaction taking place. We may, by means of these formation heats, determine the maximum efficiency of any supposed reaction, whether the reaction can be actually produced or not.

For the purpose of a general survey of the entire field, in which we are to allow no possible means of solving the problem to escape, it will be convenient to consider first the efficiency of every known oxide on the assumption that its availability is perfect, that is, on the assumption that its cost is nothing and that some method may be discovered of causing the required reaction to take place. Having determined by a process of exclusion all the known oxygen compounds, which could have a possible theoretical efficiency approaching that actually obtainable in practice with a steam or gas engine, we may then determine which, if any, of that number are available, keeping in mind that for direct or single transformation the oxide must be found in nature in such abundance that its artificial preparation is unnecessary.

All known substances, excepting fluorine and some of the rare and recently discovered gaseous elements, combine with oxygen to form oxides. Some substances combine with oxygen in several different proportions, forming a number of different oxides, and some complex compounds are formed by oxygen in combination with several other elements.

There are two kinds of electro-chemical substitution, by which an element may become oxidized, complete and partial. In complete substitution the oxide loses all of its oxygen and the element is set free in the elemental state, whereas, in partial substitution a higher oxide is merely reduced to a lower state of oxidation by giving up a part of its oxygen. We shall first examine cases of complete substitution or reduction to the free state.

In the formation of any oxygen compound there is either an absorption or an evolution of energy, always measurable as heat. In the decomposition of the oxide there is a quantitative reversal of the process.

The oxidation of a gram of solid carbon to gaseous carbon dioxide, CO_2, evolves, as previously stated, 8080 gram-calories of heat, or the oxidation of one gram-atom (12 grams) of carbon evolves 96,960 gram-calories. Similarly the oxidation of one gram of solid carbon to gaseous carbon monoxide, CO, evolves 2,382 gram-calories, or the gram-atom, 28,590 gram-calories. The decomposition of either of these oxides requires the absorption from some external source of the same amount of energy as that evolved in the formation. Some substances in forming certain oxides do not evolve energy, but absorb it from without. Such oxides in undergoing decomposition evolve the energy absorbed in their formation. Whenever a substance is oxidized by oxygen supplied by the decomposition of a previously existing compound, the energy evolved by the reaction is equal to the difference between the equivalent formation heats of the two compounds. If, for example, it were proposed to oxidize carbon to carbon dioxide, CO_2, by means of oxygen, which is to be derived from the decomposition of lead oxide, PbO, the oxidation of one atom of carbon requires two atoms of oxygen, and, hence, the decomposition of two molecules of lead oxide. The reaction is expressed chemically in the form of an equation as follows:

$$C + 2PbO = CO + 2Pb,$$

which means that one atom of carbon reduces two molecules of lead oxide to metallic lead and forms a molecule of carbon dioxide. The oxidation of the atom of carbon evolves, as explained above, 96,960 calories of energy, but the reduction of the two molecules of lead oxide absorbs 100,600 calories. Subtracting the absorbed energy from the evolved energy, we see that there is not quite enough to supply the demand. In other words, this reaction oxidizes the carbon without evolving any energy, and only by absorbing the difference between 100,600 and 96,960 or 3,640 calories. This means that, as an oxidizing agent for transforming the chemical energy of carbon into electrical energy by galvanic action, the maximum efficiency of lead oxide is *zero*, or none of the energy of the carbon can be evolved and the reaction cannot take place without the application and absorption of 3,640 units of external energy. In this reaction the chemical energy of the carbon is merely *transferred* to the lead without any transformation into electrical energy. The lead, thus reduced to the metallic state, is capable of being itself oxidized, each atom thereby evolving 50,300 calories of heat or its equivalent in other forms.

The oxidation of carbon to the monoxide, CO, instead of the dioxide, by means of lead oxide requires a relatively greater absorption of heat and rejects in the carbon monoxide 70.5 per cent. of the energy of the carbon as unaltered chemical energy.

It is evident, therefore, that in our search for an efficient oxide to be used in transforming the oxidation energy of carbon by a direct process into electrical energy, we must exclude lead oxide and all similar oxides, whose efficiency is zero. Remarkable as it may seem, this requires us to put aside as impossibilities nearly all of the known metallic oxides, narrowing our field of research to comparatively small limits.

The only oxides which, by complete reduction, have a possible efficiency greater than zero, that is, the only oxides that are theoretically capable of transforming any of the energy of carbon into electrical energy by complete reduction, are the oxides of the metals, arsenic, antimony (?), bismuth, thallium, copper, mercury, silver, gold, platinum, palladium and possibly other "noble" metals, and the oxides of the non-metallic elements, chlorine, bromine, iodine, nitrogen, sulphur, selenium, tellurium and the peroxide of hydrogen.

The maximum efficiencies of transformation of the most favor-

able oxides of the above named elements with complete reduction of the oxides and with the formation of either carbon monoxide or carbon dioxide are given in the following table together with the weight of each oxide required to oxidize one pound of carbon.

TABLE I.

Oxide.	With Formation of CO_2.		With Formation of CO.	
	Maximum Efficiency. Per cent.	Pounds required for 1 pound of carbon.	Maximum Efficiency. Per cent.	Pounds required for 1 pound of Carbon.
CuO	23.3	13.1	0	5.2
Tl_2O	19.2	70.5	0	35.2
HgO	36.7	36.0	0	18.0
Ag_2O	87.8	38.5	23.4	19.2
Au_2O_3	100	23.9	29.5	12.0
PdO_2	68.7	11.5	13.8	5.8
PtO_2	100	17.5	29.5	8.7
As_2O_5	9.5	7.7	0	3.8
Sb_2O_5	10	10.7	0	5.3
Bi_2O_5	72.7	25.7	13.6	12.8
H_2O_2	53.	2.8	6.2	1.4
Cl_2O_7	100	4.3	29.5	2.1
Br_2O_5	100	5.3	29.5	2.6
I_2O_5	81.5	6.9	20.2	3.4
N_2O_5	88	3.4	22.9	1.7
SO_3	29.	4.4	0	2.2
SeO_2	46.9	6.8	2.9	3.4
TeO_2	26.5	9.8	0	4.9
PbO_2	35.	20	0	10.

Table 1 includes all oxides that have a possible efficiency as transforming agents greater than zero, excepting the rare oxides that have not yet been determind or discovered and which cannot be of any importance in this inquiry. From this list we may exclude at once the oxides of thallium, arsenic and antimony, as having among other objections too low an efficiency to compete with heat engines. The oxides of mercury must be excluded, because they are decomposed and volatilized at temperatures below those at which they can act on carbon as oxidizing agents. In any of the reactions producing carbon monoxide instead of the dioxide, 70.5 per cent. of the energy of the carbon is rejected with the monoxide and the maximum efficiency cannot exceed 29.5 per cent., and will in all cases be much lower than with the formation of carbon dioxide.

With these maximum efficiency limits established, we must next consider the question of availability. The oxides of gold, silver, palladium, platinum, chlorine, bromine, iodine, selenium, tellurium and the peroxide of hydrogen are not found in nature, and, hence, are unavailable as "direct" agents. This leaves only the oxides of copper, bismuth, nitrogen and sulphur, from which we may select a reagent.

Bismuth oxide, Bi_2O_5, exists only in very minute quantities in nature in a few rare minerals. The oxidation of one pound of carbon to carbon dioxide by means of this substance, supposing such an electro-chemical reaction were possible, would require twenty-six pounds of the reagent. This substance is therefore unavailable for our purpose on account of its scarcity, if for no other reason. It is probable that the total quantity of bismuth oxide that has been mined up to the present time, if used in oxidizing carbon to produce electrical energy, even at its maximum efficiency of 72.7 per cent., would not be enough to supply one horse-power for one month.

Oxygen compounds of copper constitute but a very small proportion of the natural sources of that metal, while the oxidation of one pound of carbon to the dioxide would require over thirteen pounds of the most favorable oxygen compound of copper. As the maximum efficiency of such a transformation could not exceed 23.3 per cent., the best that any possible electro-chemical process could do, would be to enable us to substitute for a first-class engine, an apparatus for handling, storing and transporting thirteen tons of copper oxide for every ton of fuel used. If the copper oxide should cost nothing, we might then obtain about the same result that we are now getting with the engine. But even then the total supply of copper oxide would not be sufficient for a millionth part of the power now used. If the question of actual cost be allowed to enter the question, we need only to remember that in primary batteries consuming zinc instead of carbon, the cost of copper oxide as a depolarizer is much greater than that of the zinc, and that the copper oxide so used is almost always prepared artificially.

Sulphuric oxide, SO_3, exists in nature only in the form of sulphates (chiefly gypsum), none of which are decomposable by carbon without the absorption of energy. The efficiency of transformation with these particular compounds is, consequently, zero and they are unavailable.

Nitrogen pentoxide, N_2O_5, exists in considerable quantities in nature in combination with alkalis as nitrates, which are widely distributed and are in process of formation continually. The possible efficiency of transformation is 88 per cent. and the quantity of sodium nitrate (the most abundant source of N_2O_5) required to oxidize one pound of carbon is only 4.7 pounds on the assumption that complete reduction of the nitrate is possible. It would seem, therefore, that, if there is any possibility of a "direct" process, it must involve the employment of nitrates. In considering the availability of such a process we must allow not less than 4.7 tons of nitrate to one of fuel, which, at the present rate of production, would have a value for other purposes at least 100 times as great as that of the fuel. A steam engine having an efficiency of 1 per cent. would, therefore, compete on an even footing, at least, with such a process having the maximum efficiency of 88 per cent. Another consideration that must not be ignored is that nitrates are in great demand for other very important purposes, and that any considerable increase in the consumption would cause the price to multiply by an unknown factor. The total world's supply of nitrate, if used with the highest possible efficiency to oxidize carbon by an electro-chemical process, if such a process could be found, would furnish only an insignificant fraction of the power now obtained by the combustion of coal. The fact that many investigators are now seriously engaged in the reverse problem of trying to produce nitrates by the consumption of electrical energy, even with prodigal inffieciency, indicates that nitrates are entirely unavailable as reagents for the electro-chemical oxidation of carbon.

In seeking an electro-chemical process of utilizing any of the above-mentioned oxides for either practical or theoretical purposes, it should be remembered that none of those substances act on pure carbon to evolve energy under any circumstances below a red heat. But perhaps the mose serious obstacle, which opposes the use of any of the oxides for this purpose, is the fact that all metallic oxides that act on carbon at any temperature, do so with a tendency to form carbon monoxide instead of the dioxide. The monoxide thus formed subsequently burns to the dioxide, but this subsequent oxidation merely converts 70.5 per cent. of the energy of the carbon into heat.

We have next to consider the possibilities of partial reduction. There is a class of oxides known as higher oxides or peroxides, which may give up oxygen without being reduced to the free state, being reduced only to a lower state of oxidation. The oxides capable of such partial reduction, with an efficiency greater than zero, whose oxidation heats have been determined, are given in Table II with their maximum efficiencies and the number of pounds of each that would be required for the oxidation of one pound of carbon to the monoxide and to the dioxide.

TABLE II.

Oxide. Product.	With Formation of CO_2.		With Formation of CO.	
	Maximum Efficiency per cent	Pounds Required for 1 Pound of Carbon.	Maximum Efficiency. per cent.	Pounds Required for 1 Pound of Carbon.
H_2O_2 reducible to H_2O	100	5.33	29.5	2.65
SO_3 reducible to SO_2	34.	13.3	0	6.7
N_2O_5 reducible to NO	74.	6.0	16.5	3.0
Co_2O_3 reducible to CoO	53.6	27.3	6.3	13.6
Ni_2O_3 reducible to NiO	100.	27.3	29.5	13.6
Cl_2O_5 reducible to Cl_2O	100	8.3	29.5	4.1
MnO_2 reducible to MnO	55.7	14.5	7.3	7.2
CuO reducible to Cu_2O	31.	26.3	0	13.1
HgO reducible to Hg_2O	60.6	72.	9.8	36.
PbO_2 reducible to PbO	86.6	39.7	17.0	19.8
PdO_2 reducible to PdO	84.	23.	21.5	11.5
As_2O_5 reducible to As_2O_3	33.	19.1	0.	9.5
Sb_2O_5 reducible to Sb_2O_3	0	26.7	0.	13.3
Tl_2O_3 reducible to Tl_2O	58.2	38.	6.9	19.0

An inspection of Table II shows that all of these oxides are unavailable for our purpose for the reasons already cited in connection with complete reduction. None of these substances act on carbon to evolve energy at temperatures below a red heat and the quantity of carbon required to maintain the materials at the proper temperature would be several times as much as that which could undergo the electro-chemical oxidation. The possible efficiencies are in some cases higher for partial than for complete reduction, but the weight required to oxidize a pound of carbon is also greatly increased. Among the metallic oxides we find that the substances having the highest possible efficiencies for the purpose are generally those existing in the smallest quantities in nature and those

which would be required in the greatest quantities. It seems idle to speculate on the possibility of using rare and expensive substances as oxidizing agents of carbon, which would be required in enormous quantities; but these substances have been included in the list merely for completeness and to show the limits of possibility respecting the more abundant substances and the rare ones whose formation heats are known.

Wireless Telegraphy.

BY JAS. L. ADAMS, JR.

Since my previous communication relating to the effect produced by self-inductance on the current impulses induced in the receiving circuit of a wireless telegraph system, I have made a number of further experiments in this field, a few of which yielded results that seemed somewhat interesting, and may be considered worthy of space in your columns. All the experiments referred to below were several times repeated in order to make sure of the effects mentioned in each case.

(1.) After noting the effect produced by a gas lighting spark coil when placed in circuit between the coherer and the vertical wire, a sensitive relay measuring 5000 ohms was tried as a choking coil in its place. Although the current impulses in the coherer circuit were considerably weakened thereby, they were still of ample strength to affect the coherer, which worked when the vertical wire was attached to the outer end of the relay coils, and remained silent as long as this wire was disconnected.

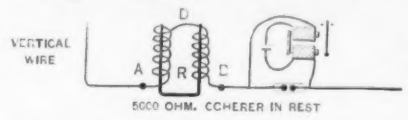


FIG. 1.

(2.) When a 15-light 1000-50 transformer had its primary connected in place of *R*, in Fig. 1, no choking effect whatever was perceptible.

(3.) On connecting the vertical wire to one of the coils and the coherer to an end of the other, the receiving instrument kept working as vigorously as ever.

(4.) As the above effect was evidently due to capacity, it led to a trial of different capacities in the receiving circuit in place of *R* in Fig. 1. It was found that a condenser made of tinfoil on window glass, whose plates or coatings were ⅛ inch x 1 inch, was amply sufficient to operate a coherer.

(5.) A condenser of this size, or somewhat larger, when placed in *parallel* with the coherer, seemed to have no noticeable effect, but a condenser having several square inches of surface on each plate when so connected, practically stopped the working of the receiving instrument.

(6.) On trying non-inductive resistances in place of *R*, Fig. 1, it was found that one or two 8-cp 104-volt lamps having each a resistance coil of about 530 ohms were quite sufficient to produce a very noticeable weakening of the coherer current; and from three to five lamps in series were sufficient to practically stop all coherer action under the same conditions of adjustment as when the inductive resistance of 5000 ohms was used.

(7.) Thinking that perhaps the high frequency waves or impulses of current were conveyed through inductive resistances by a condenser effect between the first and last few turns and the core, and without actually traversing the whole coil, an experiment was tried by opening the circuit at *D*, Fig. 1. Although the capacity of the two coils was found to be great enough to transmit sufficient energy to operate the coherer, still the effect produced on that instrument was apparently considerably stronger when the circuit at *D* was closed.

(8.) On opening the Tesla coil primary (mentioned in previous letter) in two or three places, so as to allow of capacity effects only taking place, it was no longer capable of influencing the receiving instruments.

(9) On enclosing the latter in a metallic box, having no opening except on the end turned toward the transmitter (which was perhaps 5 or 6 feet away), it was found that when the coherer had no vertical wire attached, it would operate as long as this large opening was left open or was closed by a pane of glass or a block of wood; but a sheet of tin, or wire netting up to and including a mesh of 1 to the inch, if placed directly in the opening, was sufficient to stop all coherer action. If not placed directly in the opening, but several inches away, then the coherer was not hindered from working, even though the tin sheet was much larger than the opening in front of which it is placed, thus cutting off all possible direct radiation (i. e., in straight lines) from the transmitter.

(10.) If the opening above mentioned was closed by a grating made by slitting a piece of tin, and the wire antenna of the transmitter placed horizontally so as to be parallel with the axis of the coherer, then the coherer would operate (*a*) when the slits were in a vertical position, and remain quiet (*b*) when they were placed parallel to its length.

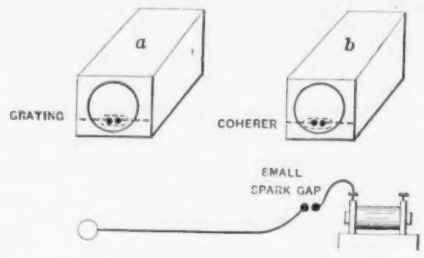


FIG. 2.—ANTENNA HORIZONTAL.

(11.) On placing the transmitter antenna in a vertical direction, leaving the coherer horizontal as before, it was found that the coherer would remain silent when the slits were in either of the two positions mentioned in the last experiment, but was not hindered from working (*c, d*), when the grating was in either of the two positions lying 45 degrees to each side of the above. In this experiment the transmitting vertical wire must be placed close to the coherer.

Experiment (10) is possible when the powerful and well-known three-sphere radiator (Fig. 3) is used as transmitter, without wings of any sort; but (11) was not found to act as above in this case, the spheres giving off waves in every direction without the polarization mentioned above in the case of the weaker waves that are radiated from a *straight wire* (which in this case was connected through a small spark gap to one coil terminal only, the other terminal of coil remaining disconnected). For trying experiment (9) the three-sphere radiator is perhaps the better. The metal box mentioned for use in (9), (10) and (11) must be large enough to contain not only instruments, but the necessary local cells to operate the same, so that no wires protrude therefrom at any point.

(12.) On touching the positive wire of a 220-volt direct-current circuit to either terminal of a coherer, it responded instantly. The negative wire had little effect unless the coherer was exceptionally sensitive, in which case it responded to either side of the circuit.

(13.) A piece of ordinary rubber cord wire 2 feet long, after being placed in contact with the positive wire of a 220-volt circuit, retains sufficient static charge at 220 volts potential, to operate an ordinarily sensitive coherer relay, upon placing the wire in contact with either terminal of the Branly tube. The effect is greatly augmented by

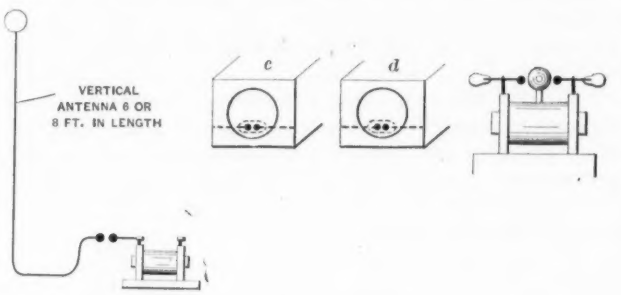


FIG. 3.—ANTENNA VERTICAL.

holding the rubber-covered wire in the hand until after it is taken from contact with the positive wire above mentioned; on releasing the hand from its contact with the outer surface of the insulation, the decrease of capacity causes an immediate rise of potential in the copper core, and it is then capable of operating the coherer several times, if momentarily placed in contact, at 2 or 3 second intervals, with either coherer terminal.

(14.) A sensitive coherer is affected by the spark gap of a small electric bell rung by one cell of battery, when the bell is held within a few inches of the tube.

(15.) In reference to the experiment mentioned by Mr. Shoemaker in the issue of July 29, it may be said that since a good coherer responds to the touch of a *single wire* when at 220 volts potential, or

even much less than half this pressure if the instrument be quite sensitive and well adjusted; and as it is practically impossible to open any circuit suddenly when carrying some little current, without a momentary rise to at least something like that potential; it therefore follows that hardly any other result could be expected than that the instrument would be affected by the breaking of the short circuit mentioned, even though the self-inductance and the e. m. f. employed be quite small.

To test the above deduction, the experiment was tried of connecting a terminal of a nickel-alloy filing coherer under as sensitive adjustment as possible, to one pole of a single cell of dry battery, and then shorting and open-circuiting the latter through a single loop of wire about 1 foot in length; the coherer and its relay responded regularly at each break. If instead of short-circuiting through the loop above mentioned, a straight piece of wire barely long enough to reach from one terminal of the cell to the other, was used, so as to eliminate even the self-inductance of the single turn, then the coherer

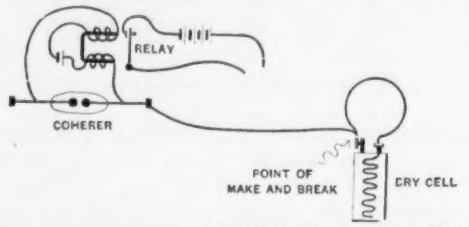


FIG. 4.—COHERER CONNECTED TO DRY BATTERY.

was scarcely affected, but only in this extreme case was it found to be impossible to definitely disturb the coherer we were using.

In connecting relays I have found it convenient to open the wire leading from one coil to the other and place the single cell required across the break, this giving a high inductive resistance between either pole of the battery and the coherer, without lessening the relay's sensitiveness by including additional reactive resistance or other impedimenta in its circuit.

The telegraph relay used in the above experiments and operated by the Branly tube, was wound to a resistance of about 1700 ohms and the armature swung on needle points; a single cell being ample for its operation. The 5000-ohm relay mentioned in (1) was found to be too sensitive for all coherers that have so far been tried in circuit with it, its resistance being so high that it was necessary to open the gaps in the coherers until they were not especially sensitive, before it seemed possible to rely on their resistance increasing sufficiently after tapping not to allow the extremely small current necessary to affect the relay a passage through the filings. With this relay two dry cells were required to energize its magnets.

Electrical Standardization—VII.*

(Concluded.)

APPENDICES.

EFFICIENCY OF PHASE-DISPLACING APPARATUS.

In apparatus producing phase displacement as, for example, synchronous compensators, exciters of induction generators, reactive coils, condensers, polarization cells, etc., the efficiency should be understood to be the ratio of the volt-ampere activity to the volt-ampere activity plus power loss.

The efficiency may be calculated by determining the losses individually, adding to them the volt-ampere activity, and then dividing the volt-ampere activity by the sum.

1st. In synchronous compensators and exciters of induction generators, the determination of losses is the same as in other synchronous machines.

2d. In reactive coils the losses are molecular friction, eddy losses, and I^2r loss. They should be measured by wattmeter. The efficiency of reactive coils should be determined with a sine wave of impressed e. m. f., except where expressly specified otherwise.

3d. In condensers, the losses are due to dielectric hysteresis and leakage and should be determined by wattmeter with a sine wave of e. m. f.

4th. In polarization cells, the losses are those due to electric resistivity and a loss in the electrolyte of the nature of chemical hysteresis and are usually very considerable. They depend upon the frequency, voltage and temperature, and should be determined with a sine wave of impressed e. m. f., except where expressly specified otherwise.

*Report of the Institute Committee on Standardization of Generators, Motors and Transformers.

APPARENT EFFICIENCY.

In apparatus in which a phase displacement is inherent to their operation, apparent efficiency should be understood as the ratio of net power output to volt-ampere input.

Such apparatus comprises induction motors, reactive synchronous converters, synchronous converters controlling the voltage of an alternating current system, self-exciting synchronous motors, potential regulators, and open magnetic circuit transformers, etc.

Since the apparent efficiency of apparatus generating electric power depends upon the power factor of the load, the apparent efficiency, unless otherwise specified, should be referred to a load power factor of unity.

POWER FACTOR AND INDUCTANCE FACTOR.

The power factor in alternating circuits or apparatus may be defined as the ratio of the electric power, in watts, to volt-amperes.

The inductance factor is to be considered as the ratio of wattless volt-amperes to total volt-amperes.

Thus, if p = power factor, q = inductance factor, then

$$p^2 + q^2 = 1$$

The power factor is the $\frac{(\textit{energy component of current or E. M. F.})}{(\textit{total current or E. M. F.})}$ and the inductance factor is the

$$\frac{(\textit{wattless component of current or E. M. F.})}{(\textit{total current or E. M. F.})} = \frac{\textit{true power}}{\textit{volt amperes.}}$$

Since the power factor of apparatus supplying electric power depends upon the power factor of the load, the power factor of the load should be considered as unity, unless otherwise specified.

NOTATION.

The following notation is recommended:

E e, voltage, e. m. f., potential difference
I, i, current.
P, power
Φ, magnetic flux
$\mathfrak{B}$, magnetic density
R, r, resistance
X, x, reactance
Z, z, impedance
L, l, inductance
C, c, capacity

Vector quantities when used should be denoted by capital italics.

SPARKING DISTANCES.

Following is a table of sparking distances in air between opposed sharp needle-points, for various effective sinusoidal voltages, in inches and in centimetres.

Kilovolts Square Root of Mean Square.	Distance.		Kilovolts Square Root of Mean Square.	Distance.	
	Inches.	Cms.		Inches.	Cms.
5	0.225	0.57	60	4.65	11.8
10	0.47	1.19	70	5.85	14.9
15	0.725	1.84	80	7.1	18.0
20	1.0	2.54	90	8.35	21.2
25	1.3	3.3	100	9.6	24.4
30	1.625	4.1	110	10.75	27.3
35	2.0	5.1	120	11.85	30.1
40	2.45	6.2	130	12.95	32.9
45	2.95	7.5	140	13.95	35.4
50	3.55	9.0	150	15.0	38.1

Theatre Heating at Buenos Ayres.

The Odeon Theatre, at Buenos Ayres, has just been heated electrically by the General Electric Company of that city, of which Mr. T. G. Fleming is the electrical engineer, under whose instructions most of the apparatus was made by his brother, Mr. M. Fleming. The apparatus with which this work is accomplished consists of nine series of resistance coils, each containing a number of elements, located within a brick chamber with an iron door, situated in a cellar under the body of the house. A tunnel leads to this chamber from a passage which brings in fresh air from the street and distributes it under the frame containing the coils, while from the top of the chamber a series of earthenware pipes—drain piping—connect with eight or ten metal registers in the floor of the theatre through which the heated air passes. All or part of the resistances can be cut in or out.

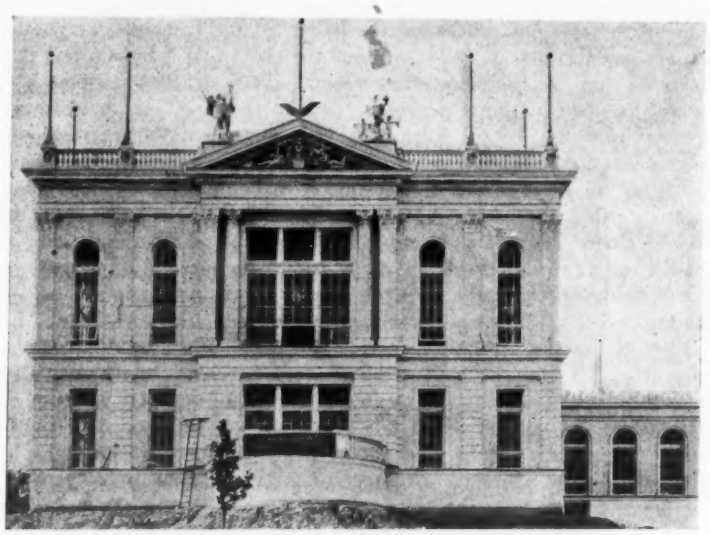
The Philadelphia Exposition.

The National Exposition of American Manufacturers for the expansion of export trade, which is to be held in Philadelphia from Sept. 14 to Nov. 30, of this year, is attracting much attention among manufacturers, who see in it large possibilities for the development of great commercial relations with foreign countries. The managers of the enterprise are displaying great activity in advancing its objects, and there is every indication that it will be liberally supported by manufacturers and others who are seeking foreign markets for their goods.

ELECTRICITY GROUP.

The exposition grounds are situated on the west bank of the Schuylkill River, south of the South Street Bridge, and are 56 acres in extent. There will be four separate buildings, covering eight acres. In one of the accompanying illustrations is shown an end view of the south pavilion of the main building. The building will be coated with white "composition." This material is said to be durable than "staff," which has of late years been generally used for buildings of this character. The building will be composed of three pavilions so connected at to form one complete structure. Each pavilion will be adorned with a pediment at either end, the pediments containing figures in relief illustrative of the six continents, viz.: Africa, Australia, Asia, Europe, North America and South America. The groups which will supplement this will symbolize "Corn," "Spinning," "Bookmaking," "Gas," "Wine," "Coal," "Cotton," "Wool," "Iron," "Electricity," "Forestry" and "Stone." Above the main entrance to the building will be a pediment typifying "Commerce," and above the pediment will be a quadriga, the central figure of which will represent "Victory." On either side will be groups representing "Transportation" and "Navigation."

The illustration at the head of this article is made from a photograph of the group symbolizing "Electricity." This group has already been placed in position on the end of the south pavilion of the main



END VIEW OF SOUTH PAVILION, MAIN BUILDING.

building. It stands 8½ feet high. From the uplifted hand of the foremost figure emerges a zigzag stroke of lightning, while in the hand of the female figure is held a cluster of electric lamps. This group symbolizes speed of electricity and progress in its uses, and in the actuality is much stronger and more pleasing than the photograph would suggest. Its position on the south pavilion is shown at the left in the lower illustration.

The plan and scope of this exposition were briefly outlined in these columns April 29 last. Much interest is being taken in the exposition abroad as well as at home.

CURRENT NEWS AND NOTES.

THE PROPOSED PACIFIC CABLE.—A Melbourne, Australia, despatch states that the Victoria Assembly on Aug. 10 adopted a resolution pledging the colony to join the Pacific cable scheme.

BEATING A FRENCH EXPRESS.—Two automobiles beat the Paris-St. Malo express in a race on July 30 between those cities, a distance of 226 miles, covering the distance in 7 hours and 35 minutes, and making the best time ever recorded for an automobile. The time of the train was 7 hours and 48 minutes.

CABLE SHIP "HOOKER" AGROUND.—A special despatch of Aug. 15 from Manila says: The United States warships "Baltimore" and "Concord" have made an unsuccessful attempt to tow off the United States cable ship "Hooker" (formerly the "Panama"), which grounded in the north channel off Corregidor Island a week ago. It is now believed it is impossible to refloat her. The "Hooker" left New York a few months ago loaded with cable to connect various of the islands for military purposes, and was engaged in the work at the time she went aground. A description of the steamer and her equipment were given in these columns a few months ago.

THE AUTOMOBILE CLUB OF AMERICA.—With the incorporation of the "Automobile Club of America" in the office of the New York Secretary of State on Aug. 15, a new word was added to the official records and a standing was given to the sport, which promises to be as popular in the New World as it has become abroad. The honor of achieving this distinction is shared for the most part by well-known residents of New York. The directors of the club, whose headquarters will be in New York City, are Frank C. Hollister, Charles R. Flint, George Moore Smith, Winslow E. Busby, Whitney Lyon, George F. Chamberlin, Homer W. Hedge and William Henry Hall, of New York, and V. Everit Macy, of Scarboro on the Hudson. Articles of incorporation, which are brief, specify that the objects of the organization are "to maintain a social club devoted to the sport of automobilism and to its development throughout the country; to arrange for pleasure runs, and to encourage road contests of all kinds among owners of automobiles." As will be noted, it is not the intention of the club to interfere directly with what may be termed the industrial aspects and interests of automobilism.

THE TROLLEY BOYCOTT IN CLEVELAND.—Not satisfied with violence and injury to property the trolley strikers in Cleveland, Ohio, undertook to enforce a boycott against all who rode in the cars and interfered to stop doctors from attendance on the dying children of men working on the lines. After enduring the annoyance of the boycott rather passively for a few days, the business men of the city at last turned in and signed in large numbers the following set of resolutions, since which time the attempt to prevent people getting food, drink and shelter because they rode on the tabooed cars has failed utterly: Whereas, An attempt is being made to establish a boycott in Cleveland, extending to all branches of business and all occupations, and restraining citizens and business men by intimidation from exercising their individual liberty; and Whereas, Such a condition is un-American, as well at detrimental to the good name of our city, to labor and to all business interests; Resolved that we, the undersigned citizens and business men, recognize that we have no right to dictate to our employees or customers as to their use of public conveyances, and we declare that we will not do so; neither will we accept dictation as to whom we shall trade with. Resolved, that without in any way expressing our individual opinions upon the subject of the existing street railway conditions, we hereby record our severest condemnation of the present attempt to boycott business men and citizens—injuring, as it does, all classes of the community, not less severely the laboring class and small dealers than those of larger business interests.

A TELEGRAPHIC CZAROWITCHESS.—A special despatch from London of Aug. 12 says: A letter received here from St. Petersburg discloses the fact that the late Czarowitch, Grand Duke George, who died suddenly at Abbas Tuman, in the Caucasus, July 10, had four sons by a morganatic marriage with a woman who had been employed as a telegraph clerk, although she was a descendant of a royal Caucasian house. According to the letter, Czar Alexander

III., father of Grand Duke George, hearing of the marriage, said: "One must not deny a dying man anything." Even then it was thought the disease from which the Czarowitch was suffering was incurable. In conclusion the letter says that possibly the present Czar will make his morganatic nephews Counts.

LORD MINTO, Governor General of the Dominion of Canada, in proroguing the Dominion Parliament on Aug. 11, remarked: "I am glad to observe that the action of Canada in deciding to unite with the mother country and the Australian colonies in the construction of a Pacific cable has met with general approval."

FOUR FIREMEN SHOCKED TO DEATH.—At a fire in Omaha, Neb., on the night of Aug. 9, in lowering an extension ladder it came in contact with an electric light wire carrying a 2000-volt current. Four firemen working the crank at the foot of the ladder received the charge through their bodies and fell to the pavement dead. The fire itself was a small one, but the after results were disastrous to the lives of the firemen. Other firemen were severely shocked.

FOR THE BRITISH NAVY.—A cable despatch from London of Aug. 12 says: The Admiralty is highly delighted at the result of the trials of wireless telegraphy in the course of the recent naval manœuvres. All who witnessed them are satisfied of the enormous value of the invention. Signor Marconi arrived in London to-day as the guest of Mr. Goschen. This means, the despatch says, that the invention is to be adopted by the British navy.

CABLE LINES NOT DAMAGED.—The great hurricane in the West Indies last week did not do as much damage to the cable lines from the United States as was at first supposed. The superintendent of the Commercial Cable Company says: "The cables and coast lines of our company are intact, and are being operated as usual. The land lines in Santo Domingo are rendered useless, and until further notice will be so. In Puerto Rico the land lines are badly crippled, and all government messages will have to be sent or taken by post." The manager of the cable department of the Western Union Telegraph Company says: "Our cables and coast lines are as good as ever, and we have not noticed any defects. The land lines are completely prostrated, both in Puerto Rico and Santo Domingo."

TELEPHONIC ENERGY.—In a recent interesting paper by Mr. Spencer, of the Philadelphia telephone plant, it is stated that a current of six ten-thousand-millionths of a milliampere will operate a telephone. One foot-pound of energy if expended in a telephone receiver will produce a continuous audible sound for over 3000 years. There is enough induction in one inch of two parallel circuits one-sixteenth of an inch apart to enable conversation in one to be heard by induction in the other. The energy used in an ordinary incandescent lamp for one hour would operate the average telephone station for one month. Attention was called to the fact that telephone connection between New York and London, if possible, might prove commercially impracticable, for the reason that the London business day is closing as the New York day begins.

ARC RUPTURING DEVICE.—A patent was granted Aug. 8 to Ernst J. Berg on a method for blowing out the arc formed on breaking an alternating circuit, whereby the current in the blowout magnet or solenoid is maintained at approximately full value until the arc has been completely dissipated. As illustrated, a fuse in a primary circuit has associated with the gap, a blowout solenoid which receives current from the secondary circuit. Owing to this arrangement, the blowout effect does not drop off as the square of the current interrupted, as would be the case if it were in that circuit, but decreases at a much slower rate owing to the tendency of the current in the secondary of the transformer to flow after its primary circuit is opened. Moreover, by reason of the fact that the current in the solenoid is out of phase with the current interrupted, the blowout effect is greater than if the blowout solenoid were in the circuit containing the fuse, as is usually the case.

A SEA WIRELESS TELEPHONE.—An Italian naval publication gives an account of experiments made with a telephone devised by Prof. Russo d'Asar, an Italian, to indicate the approach and direction of unseen vessels at sea as far away as five miles. His instruments have been tried with complete success on the warships at Genoa and Spezia. According to the source of this information, the general receiver, which is immersed in the water either at the bow or at the stern of a vessel, consists of two greatly flattened cones, separated by a broad ring. The outer edge of the ring has eighteen receivers connecting with microphones, and each joined to one of eighteen divisions of a dial on deck, nine for port and nine for starboard. When the receiver for the point northeast to port, for instance, marks the sound from a passing vessel, a white disk shuts off the corresponding compartment on the dial. The lookout then puts his ear to the telephone. If the sound becomes more intense and the disk remains in place, it is a sign that the vessel is still approaching from that direction. If the sound grows fainter and the disk disappears and then shuts off the north-northeast compartment, say, the direction taken by the other vessel can be determined.

INDUSTRIAL DEVELOPMENT IN MEXICO.—Referring to the progress in industrial development in Mexico, Mr. Antonio Leon Grajeda, Chancellor of the Mexican Consulate General in New York, and acting Consul General, in a recent interview stated that Mexico was never in a better position that she is to-day. Trade and commerce is thriving and active. "Not only is our internal commerce in good shape," he said, "but our import and export trade is growing. According to statistics prepared by my government the imports into Mexico from the United States during the first six months of the fiscal year 1898-99, amounted to $10,578,859. The exports from Mexico to the United States during the same period amounted to $50,764,767, which is about five times as much as our imports from this country amount to. Lately there has been a large increase in the importation of electric plants for lighting and power purposes. Along with these have come all sorts of general electrical supplies. Another fact that is interesting concerns the old horse cars that are exported from this country to Mexico. Mexico is just beginning to develop and enlarge her various street railway systems, and necessarily we must begin with an inexpensive equipment. The street railway owners can buy these discarded horse cars very cheap in this country. Old American street cars are to be found in cities all over Mexico.

ROTARY FIELD AND TWO-PHASE CURRENTS FROM SINGLE-PHASE CURRENTS.—Two patents were issued Aug. 8 to Charles Proteus Steinmetz on an application dated Aug. 31, 1891, which describe methods of producing a rotary field in a motor from a single-phase current, and obtaining two-phase currents from two transformers supplied with a single-phase current. The principle of the first mentioned method may be described as follows: The field frame of a four-pole induction motor is magnetically separated into two equal parts. Numbering the poles clockwise, poles 1 and 2 are on the upper half of the frame and poles 3 and 4 on the lower half. Owing to the air gap between the halves of the frames, a magnetic circuit, such as pole 1—pole 2—armature—pole 1, will have a less reluctance than the complementary circuit, pole 1—frame gap—pole 4—armature—pole 1, the reluctance of the latter being, say three times greater than that of the former. The primary winding consists, to take a specific case, of 156 turns on the opposite poles 1 and 3, and 90 turns on poles 2 and 4, the four coils being in series and connected with a source of single-phase current. On the poles there is also a closed secondary winding, consisting of 30 turns on poles 1 and 3 and 52 turns on poles 2 and 4, the larger number of secondary turns being on the poles with the smaller number of primary turns, and vice versa. The closed secondary also contains a resistance in circuit to fix the secondary current flowing. With the data given, the action of the primary and secondary currents, which are displaced in phase, and of the magnetic circuits of unequal reluctance, will cause the magnetism of adjacent poles to differ 90 degrees in phase, thereby resulting in a rotary field. Instead of splitting the field frame, the armature clearance of a pair of opposite poles may be made greater than that of another pair. Moreover, the principle may be applied to a field having any convenient number of poles. To produce two-phase currents from a single-phase current, two transformers are employed of unequal reluctance, between which the primary turns are unequally divided. A closed secondary winding including a resistance is divided into unequal parts, as in the case of the motor, the smaller coil being on the transformer with the larger number of primary turns, and vice versa. Each transformer has another secondary, and with proper proportions between the reluctances and the several first-mentioned coils, the currents flowing in these latter secondary circuits will be displaced 90 degrees in phase. The principle is also applied to a number of transformers in tandem, each transformer giving two-phase currents, in which case the regulating resistance is inserted in the closed secondary of the final transformer alone.

MUNICIPAL QUESTIONS.—The third annual convention of the League of American Municipalities will be held in Syracuse, N. Y., from Sept. 19 to 22. Gov. Roosevelt and James K. McGuire, Mayor of Syracuse, will deliver the address of welcome. Among those who will address the convention will be Robert P. Porter on the negative side of a discussion on "Municipal Ownership of Public Service Industries," and Elias Goodman, on "Inadequate Compensation to City Officials." The argument against municipal ownership will be presented by M. A. Gemunder, of Columbus, O.; M. J. Francisco, Rutland, Vt.; J. B. Cahoon, Elmira, N. Y.; Samuel Insull, Chicago, Ill.; H. L. Doherty, Madison, Wis.; Allen Ripley Foote, and many other well-known men.

THE ENGLISH PACIFIC CABLE.—The bill providing for Canada's contribution towards the cost of the Pacific cable has passed the Dominion Parliament. The financial aspect of the undertaking is based upon the report of the imperial committee of 1897, which was favored with the advice of Lord Kelvin, the distinguished scientist. Their calculation was that the cable would cost in round figures £1,492,000. Since then an increase in the cost of cable material has brought the proposed cost up to £1,592,000. Sir Sandford Fleming has calculated that the cable would earn, with a due allowance for Asiatic business, in its first years of operation, viz.: 1902, £114,157; in 1903, £153,031, and in 1904, £192,375.

TROLLEY CONTACT-SPRING SUIT.—Judge Kirkpatrick, of the U. S. Circuit Court of the District of New Jersey, in an opinion delivered Aug. 1, sustained the Anderson trolley contact-spring patent, the parties to the suit being the General Electric Company and the Rahway Electric Light & Power Company. The claim at issue was on the combination with a trolley frame and wheel, of metallic brushes between the hubs of the trolley wheel and the trolley frame. As applied, the invention consists in the use of spring copper brushes attached at one end to the trolley fork, and at the other end free to bear with some pressure on the trolley wheel hub, thus relieving the bearings from conducting the entire motor current. The court held that the Anderson patent is valid as against the defence of lack of invention, complete anticipation and lack of patentable novelty in view of the prior art; and that the device was used by the defendant was an infringement of the Anderson claims.

GERMANS AT THE EXPORT EXPOSITION.—A special cable despatch from Berlin of Aug. 12 says: The sending of delegates and models to the Philadelphia Export Exhibition has been discussed warmly in the press this week. A number of chambers of commerce of the Rheinish provinces, Brandenburg and Saxony, decline to participate, as have also a number of prominent merchants. The argument is that participation means the fostering of American competition. The government, however, takes a different view and has taken pains to make it public. The Liberal press assumes a friendly attitude. The *National Zeitung* insists that all the arguments against participation in the exhibition really tell in its favor, declaring that such an occasion for German commerce to get on a friendly footing with American merchants and importers will not soon return. The *Vossische Zeitung* and other leading commercial papers express similar views and publish the names of a number of leading merchants who will attend the exposition.

WATER POWER DEVELOPMENT.—The Empire State Power Company, which was incorporated at Albany a few days ago, purposes to develop the power of Schoharie Creek. Four dams are to be built. The first will be located at what is now known as the Van Dorn water plant, in the town of Glen, just above Fort Hunter. Here a new dam is to be built across the stream at the location of the old dam and of the same height, giving a fall of 20 feet. An electrical power generation plant is to be built here and the power it is planned will be transmitted to Fonda, Fultonville, Johnstown and Gloversville. The second dam will be further up the creek, at what is known as Schoharie Falls. Here a fall of 40 feet will be obtained. Another generating plant will be put up here to supply Amsterdam with power, heat and light. Two miles further up the creek the Bromley power will be put in use. Here the dam, as it is proposed to construct it, will give a fall of about 45 feet. The power from this point is likewise to be transmitted to Amsterdam. The most extensive work of all will be that near Burtonville. One mile above that old-time settlement a dam is to be built giving a fall of 85 feet This will be the main plant of the four, and here 10,000-hp is to be obtained. It is proposed to transmit this energy to Albany and Troy and to Cobleskill and other Schoharie County villages.

STORAGE BATTERY PATENTS.—Among the patents issued Aug. 8 were three on storage batteries. Of these, one issued to Charles W. Kennedy is a variation of a patent to the same inventor recently noticed in these columns, consisting of a number of transverse fingers connected to a conducting bar, two of these constructions interleaved and placed in a rubber pan forming a shallow cell. The finger-like transverse projections are composed of a shallow rectangular vertical frame with vertical strengthening bars; the openings in the frame are filled in with roughened thin vertical strips of lead, grooved at the top and bottom to fit the upper and lower bars of the frame. Each pair of elements is contained in a hard rubber pan with flaring sides, and a battery consists of a number of such pans and pairs of elements stacked one on the other, lugs in the pan keeping the element therein from contact with the bottom of the cell above. In a patent granted to Charles Lindenberger, Harvey Lindenberger and William B. Teal, a storage cell is described consisting of a shallow rubber box with cover, a lead plate being secured to the bottom of the box, and another to the inside of the cover. Active material composed of blocks or tubes is fitted to the top and bottom plates, respectively, numerous embedded wires or strips in the cubes making contact with the plates. The surfaces of the positive and negative blocks are separated by sheets of asbestos paper and a pad of charcoal and bibulous paper. Circulation is provided for by a channel at opposite ends of the box, the inner sides of the channel being rubber partitions forming part of the bottom and cover, respectively. The third patent, issued to William Henry Smith, of London, England, describes an element made of two perforated channeled or corrugated plates placed face to face. The vertical channels thus formed are filled with active material; a lead wire or rod passing through the centre of each channel forms a conductor, such conductors being united at the top to a conducting bar common to the several plates of a positive or negative element.

A SERIES OF DERI PATENTS.—Four patents were granted Aug. 8 to Max Deri, of Vienna, Austria, on applications filed Jan. 12, June 30 and July 27, 1898, and Feb. 23, 1899. The first mentioned relates to a method of starting alternating current motors whereby resistance is introduced into, and withdrawn from, the armature circuit without external connections to the armature. Assuming a closed armature winding similar to that of a drum armature, taps are taken to the bars of a commutator, such taps being of high resistance. The field connections are such that there may be two or four magnetic poles. The first mentioned connection is used in starting up, when there will be a difference of potential causing the armature current to pass through the resistances to the commutator and between the brushes. When, however, by means of a proper switching arrangement, the four-pole connections are made, there is no difference of potential to cause the current to flow to the commutator through the taps, the circuit therefore being confined to the low-resistance armature windings alone. The second patent is on a method involving two different arrangements for exciting the field, whereby the machine is enabled to produce simultaneously direct and alternating current, or to be worked as a motor by both descriptions of current, or to operate as a motor-generator for converting one kind of current into the other. When operating as a direct current generator or motor, the machine works in the ordinary way with commutator and brushes; when working as an alternating current generator or motor, the machine works in the ordinary way with The two different actions are produced by a single armature and one field magnet excited simultaneously by direct and alternating current. The armature may have a drum or ring winding, but so disposed in two different groupings as to correspond, one to a two-pole, and the other to a four-pole field. The field winding is in two separate parts, one corresponding to four poles for alternating current, and the other corresponding to two poles for direct current. The arrangement is such that no inducing action of one group of windings can occur on the other. If now the two windings of the field are supplied as specified, the rotating armature will produce by the action of the four-pole field an alternating current in its short-circuited winding, and a direct current in its commutator-connected windings—which currents can be utilized in part for exciting the field. The machine may also act as a direct or alternating current motor, or partake of the character of each simultaneously. In an analogous manner the combination of a rotary and stationary field may be obtained, one ex-

erting no inducing action on the other if the number of poles be different. The third patent covers a combined alternating and continuous current system of distribution. As an illustration, suppose one end of a storage battery is connected to one leg of an alternating current circuit. Designating the latter by 1, the connection from the other end of the storage battery by 2 and the other leg of the alternating current circuit by 3, we have the following currents: Between 1 and 2, a direct current; between 1 and 3, an alternating current; between 2 and 3, a combination of the two, or an undulatory wave current. If in the latter circuit an inductance be placed, the current will become approximately a direct current. As applied to electric traction, the three leads above mentioned are led along the line, 1 and 2 being supplied at intervals with direct current from a battery, and 1 and 3 with alternating current from a transformer. The direct current is used in starting a motor such as described in the preceding patent, and alternating current used when a certain degree of speed is attained; or with a battery on the car only the leads 2 and 3 are required, in which case the undulatory current passes through the battery and motor in series, the direct current component charging the battery and the alternating current component actuating the motor; the battery in turn giving current to the motor when starting. The fourth patent is on an arrangement for overcoming the armature reaction of dynamos, and consists in employing in addition to the usual field winding a second winding arranged uniformly about the bore of the field, and so connected in series with the armature that the armature current in flowing through will produce a field contrary to that of the armature, and practically equal thereto both in form and strength.

LETTERS TO THE EDITORS.

Cardew Earthing Device.

To the Editors of Electrical World and Engineer:

Sirs:—Our attention has been called to your issue of July 15, containing an account of the discussion before the National Electric Light Association and the American Institute of Electrical Engineers, on the protection of secondary circuits. Although we have not had an opportunity of reading these papers, we should be glad if you would allow us, as owners of the American patent for the "Cardew" earthing device, to draw attention to a fact which has apparently escaped notice. From an extensive use of this apparatus in England, where it is adopted as the standard instrument by nearly all the large supply companies, it is, we think, generally recognized here that the earthing device is far preferable to the grounding of the secondary, for the following reasons:

Should a slight leak develop on one pole of the secondary circuit there is a grave risk of electrolysis developing, which reduces the section of the wire to such an extent that it becomes dangerously hot and is liable to cause fire with the permanently grounded system. Further, it puts an unnecessary strain on the dielectric of the cable, which causes circuits which might remain serviceable for years to become dangerously low in insulation.

We need hardly say that neither of these can occur with the Cardew earthing device, which owes its success to its absence of all working parts which are liable to derangement, the invention merely consisting of two plates, on the lower of which rests an aluminum foil, the top plate being connected with the secondary and the lower plate to earth.

DRAKE & GORHAM.

LONDON, ENGLAND.

Wireless Telegraphy.

To the Editors of Electrical World and Engineer:

Sirs:—In the usual arrangement of the receiving circuit in wireless telegraphy it has occurred to me for some time that probably quite an appreciable proportion of the wave energy traverse the shunt circuit to ground, or is absorbed in the circuit, thus detracting from the effects on the coherer.

The series of experiments made by Mr. Adams, the results of which were published in your issue of July 15, tend to corroborate this. To obviate this and render the coherer more effective, the following arrangement is submitted for test by those who have the apparatus and the time to do so.

To the vibrating lever of the decohering mechanism, but insulated therefrom, is attached in extension a flexible "tongue" making contact at *X* when the armature of the decohering magnet is attracted, and opening the receiver circuit when this armature recedes, thus actuating the receiving relay, *R C*. When the receiving circuit is thus momentarily open, it relieves the coherer of the shunt, leaving the waves to act fully upon coherer and thence to earth direct. The usual choke coils may be retained in the receiving circuit. The transmitting vibrations should have a slightly higher frequency than the oscillations of the decohering armature in order to avoid the possible loss of a signal by synchronous movement. It may be objected that it is necessary to have the decohering mechanism constantly in vibration. Should the arrangement make further distances of communication possible, this objection would have little weight.

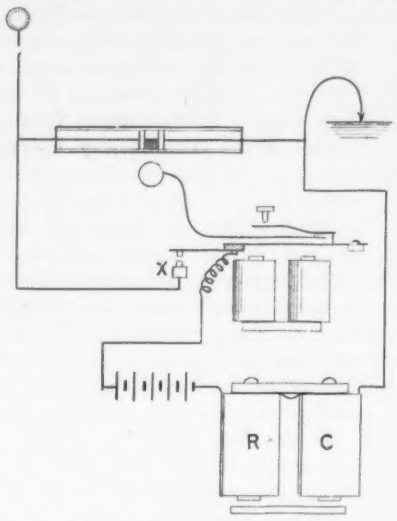


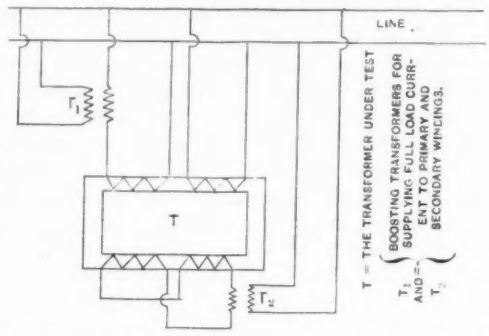
DIAGRAM OF CONNECTIONS.

SACRAMENTO, CAL. J. N. JOHNSON.

Transformer Testing.

To the Editors of Electrical World and Engineer:

Sirs:—I have read with considerable interest the article by Mr. S. E. Johannesen in your issue of July 29, entitled "A Differential Method for Testing a Single Transformer." In 1894 a 200-kw transformer having been manufactured by the Westinghouse Electric & Manufacturing Company for experimental purposes, it was very desirable to obtain a temperature test, and there being no means of loading it directly the arrangement shown in the accompanying diagram was suggested by Mr. C. F. Scott. It will


LINE
T
T = THE TRANSFORMER UNDER TEST
BOOSTING TRANSFORMERS FOR SUPPLYING FULL LOAD CURRENT TO PRIMARY AND SECONDARY WINDINGS.
TRANSFORMER TESTING, DIAGRAM OF CONNECTIONS.

be noted that this is exactly the same arrangement as is shown by Mr. Johannesen in Fig. 6, and is the one which he says may be used for testing transformers having the coils divided as shown in D and E of Fig. 1.

Notwithstanding the apparent simplicity of this arrangement, it is often difficult to get the apparatus satisfactorily arranged and the currents in the different circuits properly adjusted. Especially is this true in transformers of large size or in those wound for high voltages.

On large transformers where the magnetic circuit is divided into two separate parts, another method, less complicated than those shown by Mr. Johannesen, has sometimes been used by us. In addition to its greater simplicity, this method allows the testing of transformers in which the windings cannot each be divided into two equal parts. A few turns of flat copper strap are wound around each of the magnetic circuits, and so connected that the flux in one circuit opposes that in the other, the result being that

though the iron may be worked at full induction, there is no voltage generated in the coils. Direct current of the proper amount may then be sent through the high and low tension windings; or one winding may be short-circuited, and such an alternating e. m. f. impressed upon the other winding as will give the proper current in both circuits. J. S. PECK.

PITTSBURG, PA.

Nickel-Iron Alloy As a Substitute for Platinum.

To the Editors of Electrical World and Engineer:

Sirs:—In a recent number of your journal you mentioned the patent granted to MM. Guillaume and Dumas for an alloy of iron and nickel as a possible substitute for the platinum terminals in incandescent lamps. Since I have been experimenting with the same alloy for some time previous to the granting of the patent and have observed some phenomena not described .n the patent, a short account of my experiments may be of interest to your readers.

Hadley found that a small addition of aluminum makes the otherwise brittle alloy quite ductile, and through the kindness of Prof. E. D. Campbell I obtained, about three months ago, several feet of Hadley's "M" wire with 29.07 per cent. *Ni* and a coefficient of expansion practically the same as that of ordinary glass. The diameter of the wire was .925 mm. and its specific resistance 0.0000887 ohm, about ten times that of platinum.

I was able to fuse the wire into glass without difficulty. The joint was airtight and did not break even when heated considerably, but the wire was surrounded by innumerable little gas bubbles. These bubbles might have had their origin either in a chemical influence of the metal on the glass, or be gas absorbed during the manufacture of the wire and given off at the high temperature of fusing. The latter was the case, and we got entirely rid of the difficulty mentioned by heating the wire in a vacuum to a red heat. After cooling I fused again some pieces of the wire into glass without any gas bubbles appearing at the joint. The oxidation of the wire is very small, if properly treated. These latter experiments were made about the middle of May, and no cracking has yet occurred; I have sent for several hours a current of 5 amperes through the wire without cracking the glass. More recent experiments made with wire treated in vacuum (two months ago) showed that during the interval nothing has changed.

This alloy seems, therefore, at least after being treated in the manner mentioned, to be an admirable substitute for the expensive platinum terminals in incandescent lamps. K. E. GUTHE.

ANN ARBOR, MICH.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.
By CARL HERING.

DYNAMOS, MOTORS AND TRANSFORMERS.

Continuous Current Dynamos with Two Independent Windings.—SENGEL.—The first half of an article giving the results of experiments with the application of a third brush on an armature having two independent windings (Weston winding), the commutator segments belonging to one winding being separated by the segments of the other. Two brushes having a breadth of at least two segments, are placed in the neutral zone, and a third having a breadth of not more than one segment, is placed at any point of the commutator, between the other two brushes. He tested a four pole dynamo when running with no load and found that some sparking always occurred at the third brush, but that there was a peculiar difference in the amount of the sparking when the third brush was placed at that part of the collector which faces a north pole of the field magnet, than if it was on that part which faces a south pole; the sparking was considerably greater in the first case than in the second. For a copper brush the power at no load, less the power consumed by friction, was 108 watts in the first case and 35 in the second. For a carbon brush there was nearly an absence of sparking, the power at no load less the friction being in the first case only 20 watts, while in the second it was not measured. When this third brush connects two segments, there is a short circuit, but of a considerable resistance, consisting of the series connected parts of the two windings from the third brush to the two main brushes. To explain the peculiar difference in the two cases described above, it must be supposed that the transition resistance between brush and collector is different for different directions of the current; this he proved by an experiment which is described.—*Elek. Zeit.*, July 27.

Motors Directly Connected to Machines.—ADAMS.—He claims that such motors should be designed so as to have the appearance of being a part of the machine itself. He discusses the three methods of connecting, the direct, the single reduction and the double reduction; in nearly all cases a single or double reduction will be the best, and of these, the single reduction will in most cases be preferred. The geared motor has a decided advantage in first cost which in general is one-half to one-third that of the gearless type. Multipolar motors are better adapted for very low speeds, but for geared motors intended for machine tools the bipolar type will in many cases be found the cheaper, simpler and more convenient form.—*Eng. News*, Aug. 10.

Change of Polarity of Dynamos.—Two shunt dynamos are connected on the three wire system and are used for driving motors, some of which work at 100 volts and some at 200 volts. Sometimes, when the load is light, one of the machines is found to suddenly change its polarity, causing both the outer wires to be of the same sign. The probable causes of this change is discussed in two communications.—Lond. *Elec. Eng.*, July 28.

LIGHTS AND LIGHTING.

Testing a New Incandescent Lamp.—Two communications on the tests necessary for a proper report on a new incandescent lamp. As a substitute for the life test it is claimed that there is none better than the following test devised by Preece: If the lamp is a 100-volt lamp, it is subjected to a pressure of 170 volts for 2½ minutes. Unless the lamp is very bad, due to a bad vacuum in the bulb or an uneven filament, the lamp will stand this test. Its candle-power and the watts taken per candle are then measured again at normal voltage, and the less the candle-power and the efficiency have fallen off, the better the lamp. If the lamp is a 200-volt lamp, then 340 volts should be applied for 2¼ minutes, and so on in proportion for other pressures. By a comparison with the corresponding data for well known types of lamps an idea of the merits of a new lamp can be had. Some figures are copied from an English Post Office specification showing how the average lamps in the market stand these tests.—Lond. *Elec. Eng.*, July 28.

Nernst Light in Lighthouses.—An editorial note on the agitation which has recently been raised in England against the use of the electric arc light for lighthouses on account of the fact that the luminous rays of the carbon arc are mostly of high refrangibility and are rapidly absorbed by a foggy or misty atmosphere. What is required in a lighthouse is a beam of light containing an abundance of rays of medium refrangibility, rays in the region of the yellow part of the spectrum. The opinion is expressed that if the incandescence of ordinary solid carbon cannot produce the required rays, a higher degree of incandescence is attainable by means of the refractory oxides and that therefore there is an opportunity to try Nernst light.—*Lond Elec.*, July 28.

POWER.

Electrical Installation in Coal Mines.—GARDNER.—An illustrated article discussing the various causes which prevented a general adoption of electricity in coal mines, such as the high first cost and the large influence of the mule dealers. At present only about twenty-five out of several hundred mines in the Carbondale, Scranton and Wyoming districts have electrical plants to assist in their operation; this branch of the electrical industry seems, however, to promise well for the future. Electrical machinery must be specially designed for use in coal mines, as it is subjected there to exceedingly hard usage. The generators, particularly where electrical haulage is used, must be so designed that they will stand all kinds of sudden changes, from no load to a heavy overload. On account of safety a 220 or 300 volt

plant ought to be preferred; if the cost of copper for a long transmission line makes it necessary, a 500 volt current is used.—*Amer. Elec.,* August.

Gas Engines versus Electric Motors.—A short comparison showing that the cost of the gas consumption in the gas engine is less than the cost of electricity for an electric motor, but as to oil, wear and tear, attendance and other items, the electric motor is better than the gas engine.—Lond. *Elec. Rev.,* July 28.

REFERENCES.

Hydraulic Power Plant.—A short note on the plant now being constructed at Sault Ste. Marie, Mich., by the Michigan Lake Superior Power Company. The turbines are to be direct-connected to single-phase low-voltage generators, which will supply step-up transformers. The power at the point of delivery will be 40,000 hp.—*Eng. News,* Aug. 3.

Electrically Driven Air Pump.—A short illustrated description of a pump, forming part of a condenser equipment of the generating station in Glasgow, England.—*Eng. News,* August 10.

Tests of Alternators.—Brief records of the official tests of some 200-kw Ferranti-Maclaren steam alternators with various loads.—Lond. *Elec., Elec. Rev.* and *Elec. Eng.,* July 28.

TRACTION.

Modern Mine Haulage Practice.—MYERS.—A paper referring chiefly to compressed air locomotives and a combined accumulator and trolley locomotive, used for haulage in coal mines. Some general figures are given stating that there are in use about 50,000 miles of mining track, presumably in this country, with an average haul of one mile per ton at a cost of 15 cents; operated with mules the total cost of transportation would be $60,000,000 per year, which shows the importance of the adoption of mechanical haulage. A number of illustrations are given of modern compound compressed air mine locomotives, including some data and indicator cards; 500 volts is said to have been used seldom on electric mining lines; 250 volts will even kill a mule if the wire falls on it. The reference to electric haulage is limited to an illustrated description of a combined storage and trolley locomotive designed to haul a loaded car on the level, weighing 9000 pounds, with the current from the storage battery which is composed of 90 cells; the weight of the locomotive including the battery is 9000 pounds and is equipped with two motors of 10-hp. It is run partly from the trolley line and partly from storage; it has been running about three months and the work it has done is said to be ideal. It produces a tractive effort up to the point of adhesion when working on storage; it will haul seventeen empty cars, weighing 60,000 pounds, including the locomotive, up a 1 per cent. grade (presumably when used with the trolley current); the saving in mules and men by this locomotive is said to be $8000 annually; six other similar locomotives are under construction. On mining locomotives the rheostat type of controller is generally used, but it will probably be superseded by the series parallel type. A mule and a locomotive can produce a tractive effort of one-fifth of its weight as a maximum, and one-seventh for regular work, showing that the mule is very efficient as far as effort is concerned, but very deficient as to speed. He thinks compressed air and electric locomotives will in the near future completely displace the mule. In the discussion it was brought out that there were not over 50 compressed air locomotives in use in the United States at present, while the number of electric locomotives may possibly be 250; the compressed air plant is more expensive in first cost; the efficiency of the electric motor is 75 per cent., while with compressed air 50 per cent. is the maximum with triple expansion compressor and compound locomotive.—*Proc. Eng. Club of Phila.,* July; abstracted in *El'ty,* Aug. 9.

Combined Trolley, Conduit and Accumulator Railway.—An illustrated description of the mixed system used in Berlin, Germany, a portion of which, outside of the city, being run with accumulators, and both the trolley and the underground systems being used on the portion within the city limits. Each car running in the city has a trolley pole and an apparatus for taking the current from the conduit. For the conduit system, the two conductors, one of which is for the outgoing and the other for the incoming currents, are simple T irons, with the head vertical, and are set in the same horizontal plane. On the side away from the conduit the rail is of the ordinary type set in concrete. On the side of the track over the conduit the rail is made up of two similar rails, between which is left a slot 1 1-3 inches wide. The exterior one of these two, alone supports the car-wheel, and the slot for taking the current also carries the wheel-flange. The Berlin authorities claim that the placing of the conduit under one rail results in a greater economy in iron and ultimate cost than if this conduit were in the middle of the track, as is the American practice. The installation serves a very crowded district. The Behrenstrasse-Treptow line is only two and a quarter miles long, but carries not less than 33,000 passengers per day. The cost of installation was $24,200 a mile for single track, and twice that for double track. In this cost is included the complete installation of the conduit in concrete, with the cast iron frames and conductors, etc. The rails are not included.—*Eng. News,* Aug. 3.

Trolley Line Construction in England.—Three well illustrated articles describing the tramways of Blackpool, St. Helens (see also Digest, Aug. 12) and Hull, also a short description of the Oldham, Ashton-under-Lyne and Hyde tramway, on all of which the overhead wire system is used. In Blackpool this system has replaced the conduit system, which had to be given up because the line, located on a sea front exposed to heavy seas and to silting of sand, often became absolutely inoperative. From the articles, as well as from an editorial on the new installations, it appears that the æsthetic question is a most important one in England. At Blackpool the construction of the trolley has been made very artistic, the brackets on the poles being very short; side trolleys on the cars and of a considerable length had to be used, sometimes nearly at right angles to the cars. The generators consist of two Parsons steam turbo-dynamos aggregating 400 hp.—Lond. *Elec.,* July 28.

The former steam tramway from Dudley to Stourbridge, now operated electrically by overhead wire, is illustrated and described in the Lond. *Elec. Rev.,* July 28.

Three-phase Railway in Switzerland.—A note stating that the Burgdorf-Thun railway, twenty-five miles long, has just been opened. It is electrically driven by three-phase currents at 750 volts, the power being derived from the river Kander, the power house near Spiez, about six miles from Thun and thirty-one miles from Burgdorf. The current is generated at a pressure of 4000 volts and then transformed up to 16,000 volts, at which it is transmitted by overhead wires to fourteen transformers along the line. A detailed description is promised.—Lond. *Elec.,* July 28.

Moving Platform.—An illustrated description of the moving platform devised by Blot, Guyenet and Mocomble, which will be used at the Paris Exposition of 1900. There will be two platforms, moving with speeds of 4 and 8 km. per hour respectively, each being drawn with the aid of an endless strap, by 150 stationary electric motors. The use of stationary motors instead of movable ones, is the chief difference between this and the American system; it is claimed to reduce the moving weight, and to facilitate the attendance to the motors. A trial on a small plant, with three-phase induction motors, was very successful. In the installation in Paris, continuous current motors will be used in order to facilitate the starting and to be able to adjust the speed, if necessary, to the requirements of the traffic and to the taste of the public.—*Elek. Zeit.,* July 20.

Handling of Railway Car Controllers.—An editorial on the question how to handle the controllers in order to obtain the greatest economy. To get up hills, it is better to connect the motors in parallel than in series. The torque required to move the car at a uniform speed is approximately the same, whether that speed is high or low; if this torque requires 40 amp. in a special case, the current demand is 40 amp. or 80 amp. respectively by using the series notch or the parallel notch, but the speed in the former case is somewhat less than half, therefore the Joule effect wasted during the climbing of a certain hill is over twice as great than in the latter case. In the case in which the demand upon the distribution system or any particular feeder becomes so great as to cause an excessive drop of potential between the power house and the cars, it is advisable to connect the motors in series. For ordinary running with frequent stops the greatest economy is obtained by starting the cars as rapidly as possible, advancing the controller notch to the full speed position as soon after starting as possible, and turning off the power completely as soon as conformity with the schedule will permit, allowing the car to drift as long before the brakes are applied for the next stop, as possible.—*Amer. Elec.,* August.

Brakes for Electric Railways.—SCHIEMANN.—A long illustrated paper read before the Electrotechnical Society of Berlin, discussing the different brakes at present in use and describing a new electromagnetic rail brake, which combines the advantages of electromagnetic brakes with the safety of the brake which consists of a sort of wedge between the rail and the front side of the wheel. The new brake consists of a row of electromagnets carried on links over the

rails between the front and the rear wheels; the poles of the magnets, which are alternately of opposite polarity, act to draw this bar down to the surface of the rail; at each end there is a brake shoe which presses against the tire of that wheel which is just behind the rail brake; thus the friction of the rail brake against the rail presses this brake block against the wheel, both together acting somewhat like the wedge brake above mentioned; the Foucault currents induced are also said to have a braking effect. The brake is in use on a number of lines and has been tested and approved by recognized authorities.—*Elek. Zeit.*, July 27.

Accumulators for Automobiles.—INMAN.—A summary of the data of accumulators in use at present. The Fulmen accumulator gives 30 watt-hours per kg of total weight, at 1.5 watt per kg, 25 watt-hours at 5 watts per kg, or 20 watt-hours at 10 watts per kg. After making due allowances, he calculated that theoretically a maximum of 28 amp. hours per kg and 54 watt-hours per kg of total weight could be obtained, but these figures have never been reached. The Fulmen accumulators, according to a test of Hospitalier, yielded 25 watt hours per kg of total weight at 5 watts per kg. A 13 plate cell of the French chloride accumulator discharged in 3½ hours gives 7.7 ampere hours per kg of total weight, and 14.7 watt hours per kg at 4.1 watts per kg, total. In the Pulvis accumulator the active material is lead powder or granules without oxide; the capacity is 9.3 amp. hours, or 18 watt hours per kg total at 3.6 watts per kg total. The Pisca accumulator, in which the active matter is embedded in a honeycombed plate, gives, if discharged in three hours, 6.5 amp. hours, or 12.2 watt hours per kg total, at 4.1 watts per kg total. The accumulators of Valls & Co. are of three types, normal, light and extra light. The total weights of a cell are 15.95, 11.4, 8 kg respectively; the negative plates are of soft lead with very small cells containing the active material, thus providing a large surface of contact between the active material and its support; each plate is covered by a plate of perforated ebonite. The three types have the following characteristics: the capacity in ampere hours per kg total is 8.0, 10.5, 10.6 respectively, in watt hours 15, 20, 20.4, at 3.0, 3.3, 3.6 watts per kg total. In the Blot accumulator both plates are of the Planté type with large surface of active material and a thickness of only a few hundredths of a millimeter; hence the coefficient of utilization is large; the plates are of antimony lead. Special types of the Blot accumulator are made to give 12 ampere hours per kg of plates at a 4 hour discharge; no further figures are given. The author concludes that makers of accumulators, having due regard for durability, do not care to exceed a mean of 15 watt hours per kg. Assuming one-third of the total weight of a car to be accumulators, the distance run by one charge would be 40 to 50 kilometers. The Automobile Club has organized another set of trials of an international character for next April; the chief points are: duration of the batteries, industrial output, ratio between energy furnished and delivered, operation, weight and capacity ratio of accumulators, the conditions are those under which automobiles are called upon to work; the trials will last six months.—*Revue de Phys. et Ch.;* translated in abstract in Lond. *Elec. Rev.*, July 21.

REFERENCES.

Niagara Gorge Railway.—RICKER.—A description of the construction of this electric railroad and some of the difficulties involved in the construction and maintenance. There are a number of illustrations, including views, cross-sections, and a plan.—*Proc. Eng. Club* of Phila., July.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Installation Estimates.—In the continuation of this series (Digest, Aug. 12) the data and cost of installation material, such as the dynamo, belt, main switchboard, distributing boards, cables and wires, casing and capping, jointing material, switches, fittings, are given for different numbers of lamps in form of a large table. For the amount of cable and wire required for an installation, 13 to 14 yards (of all sizes of wire) per lamp or point is claimed to be a very good average. Some instructions are given for installations in which accumulators are used.—Lond. *Elec. Rev.*, July 28.

Louisville Electric Light Plant.—HUBLEY.—A well illustrated description of this plant generating alternating current, series arc current and 500 volt power current. For power purposes three 500 volt direct current generators aggregating 875 kw are used. The single phase alternating current is generated by four 500 kw. alternators. Three 65-light, twenty 80-light and one 125-light arc dynamos comprise the arc lighting equipment of the station, and aggregate 1920 arc lamps of nominally 2000 c. p. each.—*Amer. Elec.*, August.

Meter and Meter Rates.—DION.—A paper read before the Canadian Electrical Association. He shows how meter rates have a direct bearing upon the increase of profits from electrical supply; a change from flat to meter rates invariably lowers the peak of the station load curve to such an extent that the lamp installation may be doubled before the peak regains its present value. The meters now in practical use are briefly discussed, current meters as well as energy meters. He shows the importance of a well organized meter department for a central station, with a properly equipped meter room, where every test of meters should be performed. Explicit directions are given, how to make the tests, further also how to install the meters and how to read them. Among the systems of meter rates, the Wright maximum demand system is discussed, and it is claimed that this would enable the electric light companies to better compete with gas in the case of such long-hour consumers as drug stores, hotels, etc. The following systems are also considered briefly: Differential meter rates based on the installation, that is, charging the higher rate on the first hour of daily use of all the lights installed; two-rate meters; a fixed price per light to cover fixed charges wholly or in part, and low meter rate.—*Can. Elec. News*, July.

Electrical Engineering in Switzerland.—The first of a series of illustrated articles, including a description of the Alioth works near Basle, and of the electric tramways and electric lighting of Basle. Alioth induction motors are described, all the sizes of which over 3¼-hp are fitted with starting resistances mounted on the spindle and rotating with the armature; in starting, the resistance is in series with the closed circuit armature; but when the motor has fairly started, a brass knob is pushed in and the armature is thereby short-circuited. The arrangement is shown clearly by three figures.—Lond. *Elec.*, July 21.

Change from Alternating to Continuous System.—A note stating that in Halifax, England, such a change will take place for those portions of the mains which are for the central part of the town. The report of the consulting engineer is reprinted in abstract.—Lond. *Elec. Eng.*, July 21.

REFERENCES.

Combined Lighting and Traction Plant in Plymouth.—The first part of a long, well illustrated description of this plant, which was designed by Rider (see his paper, abstracted in the Digest, July 15). Alternating current is used for lighting purposes and a direct current at about 500 volts for the tramways.—Lond. *Elec. Eng.*, July 28.

London.—A summary of operating statistics for the stations in London, for 1898, compiled from various sources.—Lond. *Elec. Rev.*, July 28.

WIRES, WIRING AND CONDUITS.

Electrical Subways in San Francisco.—A short note stating that seven of the telegraph, telephone and electric light companies of San Francisco have agreed to carry out an ordinance drawn by the Merchants' Association, providing for the burial of their wires.—*Eng. News*, Aug. 3.

REFERENCES.

Charts for Determining the Current in Two and Three-Phase Lines.—HAYES.—Two charts for readily finding the current in the wires of two or three phase lines for a given number of kilowatts or horse powers, with a given voltage and power factor.—*Amer. Elec.*, August.

ELECTRO-PHYSICS AND MAGNETISM.

A New Vacuum Phenomenon.—FOMM.—A description of a phenomenon observed in a long thin vacuum tube which is provided with two external electrodes in the shape of rings of thin wire surrounding the ends of the tube. As exhaustion proceeds the well known succession of phenomena is observed, namely, spark discharge, positive and negative light, formation of dark space, and stratification of the positive light. Then blue rings appear, concentric with the wire rings, and enclosing patches of positive light, which gradually disappear until the blue light fills the whole cross-section. Then the blue light detaches itself from the glass walls and expands laterally while contracting in the plane of the rings, until a greenish-blue beam is formed proceeding in the direction of the other ring, but always perpendicular to the plane of the generating ring, whatever be the position of that ring with respect to the axis of the tube; it produces vivid phosphorescence where it impinges upon the glass wall, sets in motion a little paddle wheel mounted in its path, and is deflected by a magnet, the centre of rotation being the geometrical centre of the ring.—*Wied. Ann*, No. 7; abstracted in Lond. *Elec.*, July 28.

The Conductivity of Flames.—WILSON.—An abstract of a Royal Society paper describing experiments made with flames containing salt vapors. The current was measured which flowed between two gauzes of platinum wire placed horizontally in the flame one above the other, and for voltages up to 800. He found that nearly all of the ionization of the salt vapor takes place at the surfaces of the glowing electrodes and not throughout the volume of the flame. The relative velocities of the ions were estimated and that of the positive ions was thus found to be about 60-cm per second, while that of the negative was about 1000, or about 17 times as great. He also determined the relative velocities of ions of various salts in a current of air at 1000° C., leading to the conclusion that the velocity of a gaseous ion in a given medium depends only on its charge. The phenomenon of unipolar conduction can be easily explained from the fact that the ionization takes place only at the surface of the electrodes and that the velocity of the negative ions is much greater than that of the positive.—Lond. *Elec.*, July 21.

Cathode Rays.—WEHNELT.—An attempt to explain the contradictory results concerning the shadows cast by cathode rays. The rays issuing from the cathode in a direction normal to its surface cross each other freely, and do not mutually influence each other; they therefore produce reversed shadows of intervening obstacles. The upright shadows occasionally met with are due to another class of rays, which run parallel to the axis of the tube. The difference between the two classes of rays is shown by mounting a chalk screen in a position nearly parallel to the axis of the tube and by observing the shadows of a glass rod capable of turning about a shaft in the side of the tube.—*Wied. Ann.*, No. 7; abstracted in Lond. *Elec.*, July 28.

Coherer.—SUNDORPH.—A simple demonstration of the formation of connecting chains of particles in a coherer. Two metallic rods, a few millimetres apart, are attached to a horizontal glass plate, and the gap filled up with a thin layer of powdered nickel or iron. After the conductivity has been given to the layer by means of sparking or by repeated shortcircuiting, the greater part of the power is removed by means of a feeble magnet. What remains forms a set of rows of particles cohering lightly. The fact that heating destroys the conductivity, while cooling does not, is explained on the ground of the longitudinal pressure which breaks the heated rods, while they withstand a tension produced by cooling.—*Wied. Ann.*, No. 7; abstracted in Lond. *Elec.*, July 28.

REFERENCES.

Self-Recovering Coherer.—BOSE.—A reprint of the article noticed in the Digest, Aug. 12.—*El'ty*, Aug. 9.

ELECTRO-CHEMISTRY AND BATTERIES.

Transference Ratios with Varying Membranes.—BEIN.—A review of the various values for transference ratios of salts obtained by different methods leads to the general conclusion that the relative velocity of the kation is in all cases less when a dividing membrane is used than without it. This difference is most marked for animal membranes, and is small or negligible for porous clay divisions or for parchment paper. He found this result from various measurements of the transference ratios of hydrogen, sodium, lithium, calcium and cadmium chlorides with different membranes. This influence of the membrane does not appear to depend on its general permeability, but may be due to a chemical activity of the membrane, which would therefore possess the character of an acid, or to polarization induced by the current in the membrane.—Abstracted in the Lond. *Elec. Eng.*, July 21.

Amalgams.—RICHARDS and LEWIS.—The results of an investigation on some electric properties of amalgams. The e. m. f.'s of cells of zinc and cadmium amalgam of various concentrations, and of amalgams against pure metal were determined and, except in the case of the highest concentration, the temperature coefficient was found to be constant, in accordance with a theoretical conclusion. The contact e. m. f. between pure metal and amalgam was determined, but was only appreciable in the case of cadmium amalgam, for which it reached about 0.05 volt.—*Zeit. fuer phys. Chemie*, vol. 28, p. 1; abstracted in Lond. *Elec. Rev.*, July 28.

Calcium.—MOISSAN.—A short account of his experiments to obtain pure calcium in large quantities. He used two methods, one purely chemical, and the other consisting in the electrolysis of iodide of calcium fused at a dull red heat. A cylinder of pure nickel was used for the negative electrode, and a rod of graphite for the positive. No further details of the process are given.—*Sc. Amer.*, July 29.

Tanning Leather.—MABERY and LANDGREBE.—A description of an investigation to study the influence of the electric current on the chemical changes in tanning leather, and in hastening the process. The tanning was completed in 1.5 days, while without electricity it required 6. The current is supposed to assist in the intimate contact between the inner hide substances and the oxygen, and also in precipitating the coloring matter, leaving only a clear tanning solution to permeate the skin. A table of nitrogen determinations in sheep and calf kins with and without electric tannage is given, showing that nitrogen is removed during electrolysis.—*Proc. Am. Assn. Adv. Sc.*, 1898; abstracted in *Leather Manufacturer* 9, 138, and *Tech. Quart.*, March.

REFERENCES.

Influence of Pressure on the Conductivity of Solutions.—BOGOJAWLENSKY and TAMMANN.—The influence of pressure due to changes in volume, viscosity, degree of dissociation and dissociation of the solvent is analytically discussed and the results of measurements of the conductivity of solutions at high pressure are given.—*Zeit. fuer physik. Chemie.*, vol 27, p. 457; abstracted in Lond. Elec. Rev., July 28.

Variance of the Voltaic Cell.—BANCROFT.—He takes exception to the Nernst method of the application of the phase rule to the voltaic cell and illustrates its use in numerous cells; he also illustrates the application of Le Chatelier's theorem for predicting qualitative changes in e. m. f. produced by changes in variables on which the e. m. f. depends.—*Jour. Phys. Chem.* 2, p. 227; noticed briefly in *Tech. Quart.*, June.

Electromotive Forces Between Amalgams.—CADY.—A paper in which he verifies experimentally, the independence, as required by the osmotic theory, of the e. m. f. in various amalgam cells, from the nature of the solvent, and the concentration of the solution required.—*Jour. Phys. Chem.* 3, p. 107; noticed briefly in *Tech. Quart.*, June.

Dissociation Power of Solvents.—KAHLENBERG and LINCOLN.—An abstract of an article noticed in the Digest, July 29.—*Tech. Quart.*, June.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Electrical Resistivity of Mixtures of Plumbago and Clay.—FLEMING.—Since 1891 he has used rods of plumbago and clay as resistances in high voltage circuits. These rods are very handy and cheap and may be used in all cases where a high resistance of not very accurately defined amount is required. From the numerous data given in the article it appears that by the variation of the proportions of clay and plumbago any required resistivity within very wide limits can be produced. The specific resistances varied somewhat, but a fair idea of the values may be obtained from the following averages. The rods were made about a half inch in diameter and 6 or 8 inches long and were composed of plumbago mixed in various percentages with fire-clay and then fired; the measurements were made in 1892. With 50 per cent. plumbago the resistivity in C. G. S. units is 125,000,000, which is a specific resistance of about 28 times that of a good arc lamp carbon; for 45 per cent. it was 143,000,000; for 40 per cent. it was 125,000,000; for 30 per cent., 309,000,000; for 10 and 15 per cent. the resistivity increased very greatly, but the various determinations differed very greatly from each other; rods 1.2 cm in diameter, 20 cm long, of a 10 per cent. mixture had resistances varying from 400 to 800 ohms. With 50 per cent. of plumbago the watts per sq. cm. of surface was 0.117; other figures are also given up to 0.166. Some useful data is also given for arc light carbons; a rod 6 mm in diameter and 20 inches long has one ohm and carries five amperes easily, at which the power expended in it amounts to 0.25 watt per sq. cm. of external surface. The specific resistance of arc light carbons may vary from 4000 microhms per cb cm to 14,000; it is therefore possible to make a plumbago-clay rod having 20,000 to 30,000 times the specific resistance of arc light carbons. When incandescence is produced, disintegration of the material is started and the resistance changes so rapidly that the material soon becomes useless. Editorially, the opinion is expressed that if the earthy material could be thoroughly fluxed round each little particle of carbon so as to isolate it completely from the others, a resistance capable of continuously standing incandescence might easily be obtained.—Lond. *Elec.*, July 28.

In another communication he claims that the invention of the new resistance material made by the Electrical Resistance and Heating Company (mentioned in the ELEC. WORLD AND ENG., Aug. 5) is not

original, the same invention being embodied in a patent specification, No. 2395 in 1885 by Nussbaum.—Lond. *Elec.*, July 28.

Measurement of the Frequency of Alternating Currents.—SMITH.—An illustrated description of a method of measuring the frequency if its value is known approximately. A weighted fork is mounted horizontally and is provided with a metallic contact maker consisting of a sharp pointed stile, which is attached to one prong and vibrates over a smooth surface formed by two blocks of ivory, separated by a sheet of platinum about 0.02 inch thick; proper adjustment is possible in order that the stile may make contact with the platinum at the middle of the stroke of the prong. The contact maker is connected in series with a telephone and with the source of the alternating current. When the fork is set in vibration, the stile makes contact at the middle of each stroke of the prong, and if the periodicity of the alternating current is the same as that of the fork, the contacts will occur at the same point on each successive current wave, and there will then be a steady sound in the telephone or no sound, depending on the phase difference between the current and the fork. If, however, the periodicity of the current is changed slightly, the periodicity of the fork remaining unchanged, there will be fluctuations of sound causing marked beats, the frequency of the beats depending on the amount by which the periodicity of current and fork differ. The weights on the prongs of the fork are then adjusted until there are no beats, and as the fork has been previously rated, the periodicity of the current becomes known. If a fork is rated at a certain periodicity, it measures not only the variation of the frequency of currents of the same periodicity, but also that of currents which have a periodicity one-half as great or one and a half times as great. The device by which the fork is electrically driven is described.—*Tech. Quart.*, June.

Production of an Accurate Sine e. m. f.—HANCHETT.—An illustrated article on some devices which can be used for this purpose. A rotating rectangular coil, mounted on an axis which is placed at right angles to the earth's field of force, produces a true sine e. m. f. provided that the current drawn from it be not so great as to react on the earth's field. A greater current can be drawn from a small loop or a small drum armature wound on a wooden core, revolved in the field of a very heavy magnet with two opposite and parallel poles very large in proportion to the armature. For low frequencies the following method can be used; in the centre of a rectangular tank there is a fixed electrode around which travels another at constant speed and in a true circle; if a continuous current is passed from one side of the tank to the other, then an alternating current with a true sine e. m. f. can be drawn from the two electrodes. A curve of great accuracy is obtained by the following method: the ends of a straight conductor of high uniform resistance are connected to two equal storage batteries in series; lengthwise over this rod travels a small collecting brush, driven by the well known crank disc and plate, in a simple harmonic motion; the e. m. f. between the brush and the middle connection of the batteries follows the sine law. Two other devices similar to the last are also described.—*Amer. Elec.*, August.

Storage Battery for Testing.—GLOVER.—An illustrated description of a small storage battery of high e. m. f. for use in testing. The electrodes are made of sheet lead strips, each bent so as to form two electrodes, the positive of one cell and the negative of the adjoining. The two electrodes in one cell are separated by two pieces of glass tubing, one being used as a filling funnel, the other as a vent for air and gases. The electrolyte is diluted sulphuric acid of 22° B. The forming of the active material should be carefully performed. The cost of a 50-cell battery is claimed to be $1.63.—*Amer. Elec.*, August.

Wehnelt Interrupter.—VOLLER and WALTER.—Some valuable hints concerning the nature of the process of interruption are given by their spectroscopic analysis of the spark produced in the Wehnelt interrupter at the break. The red color of the spark suggested the presence of an excess of hydrogen vapor and an analysis of the vapor disengaged at the anode proved that its amount was 2½ times the normal amount demanded by Faraday's law. The hydrogen lines were very clearly shown in the spectrum. Platinum lines were also distinctly visible, and very pure and intense spectra of other metals may be produced by putting them in place of platinum, especially by reversing the ordinary action of the cell and making them cathodes. The spectrum lines of a metal may thus be obtained in two different ways with the same induction coil, by putting the cell either in the primary or the secondary circuit.—*Wied. Ann.*, No. 7; abstracted in Lond. *Elec.*, July 28.

REFERENCES.

Wehnelt Interrupter.—HEINKE.—The conclusion of his long article on the intermittent continuous current produced with the aid of a Wehnelt interrupter (Digest, August 12). The pulsating e. m. f. and the energy are discussed analytically, the results of measurements being given, proving the correctness of his theory.—*Elek. Zeit.*, July 27.

Photometer.—A short illustrated description of the Preece-Trotter portable photometer, which is claimed to be compact, simple and reliable. As standard a small amylacetate lamp is used. A description has already been given in the Digest.—*Eng. News*, Aug. 10.

Methods of Determining the Frequency of Alternating Currents.—KINSLEY.—A reprint of the article noticed in the Digest of July 8.—*Sc. Am. Sup.*, Aug. 12.

Thomson Bridge.—DUBREUIL.—The first part of an illustrated elementary description of the Thomson bridge and how to use it practically for measuring the resistance of homogenous conductors.—*L'Elec.*, July 8.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Problem in Telephone Engineering.—SPENCER.—A paper outlining the present general telephone system, discussing some of the details and the general problem of telephone engineering, and indicating some possible methods of solving some of the difficulties. His general description refers more particularly to the system used in Philadelphia, where there are eleven central offices. The paper scarcely admits of being abstracted, but the following extracts may be of interest. To illustrate the sensitiveness of the receiver, he states that it has been calculated that the telephone will respond to six ten-thousand-millionths of a milliampere and that one foot-pound of energy in a telephone receiver would produce a continuous audible sound for over 3000 years. To show the difficulties encountered in inductive disturbances, he states that it has been found experimentally that if one inch of each of two telephone circuits equipped with standard apparatus, are parallel at a distance of a sixteenth of an inch, conversation on one circuit can be clearly heard by induction on the other; this shows how impossible it is to satisfactorily balance a telephone circuit with respect to a single wire. The power that would light an ordinary incandescent lamp for one hour would operate the average telephone station for about one month. The mean frequency of the alternating currents in the telephone line may be considered to be about 1200 complete cycles per second; when the effect of capacity on power circuits with frequencies of 30 and 40 is considered, the enormous effect of capacity on telephone currents will be appreciated. Concerning transoceanic telephony, he states that while it is at present impossible, it will probably be possible within a few years; there is apparently no limit to the distance of telephone communication, but he questions whether there would be enough use for a telephone connection between New York and London to make it commercially possible on account of the difference in longitude, as the London business day closes about as the New York business day begins; this is shown with overlapping load diagrams for London and New York and for San Francisco and New York. A 24-hour load diagram of a Philadelphia office is also given, showing a maxiuum between 10 and 11 in the morning, then a temporary minimum between 12 and 1, and a second maximum, lower than the first, between 2 and 3. He seems to advocate the use of two telephones, one for incoming and the other outgoing messages, making a comparison with two doors, one for entering and the other for leaving. It has been found that a line is in use for an average of about two minutes for each conversation, making the total maximum number of calls about 30 per hour; with 15 calls per hour the possibility is therefore that a busy report would be given on a call on that one line, once out of two times. One of the hardest problems to solve is how to handle these busy reports. He discusses the question of the calls to a particular person or simply to any one at the office; for local business the latter forms about 75 per cent., but as the distance increases the percentage of business for some particlar person increases almost to 100 per cent., which involves difficulties. He does not think it is at all probable that automatic systems, that is, those without an operator, will be a success, although the elimination "of the personality of the operator" may be accomplished. In conclusion he calls attention to the origination of telephone apparatus in this country and the copying of it and introduction of American apparatus abroad; all of the important material for the new telephone systems in London is American. He adds that it has not yet been possible to install in this country apparatus that was not antiquated

before it could be used, which indicates how rapid the improvement in telephone methods has been. Some diagrams are also given which show the comparison of "good" calls and "busy" reports in 24 hours in various lines of business.—*Proc. of Eng. Club. of Phila.,* May.

Wireless Telegraphy.—A note on some experiments in wireless telegraphy and on the firing of explosives by means of Hertzian waves, performed recently at Newbury, England. A miniature powder magazine was blown up by means of Hertzian waves generated at a distance of 400 yards from the magazine. A balloon, fitted with wireless signaling apparatus, then made an ascent, and continuous signaling was carried on between the balloon and the ground. Small cartridges of guncotton suspended from the balloon were also fired from the ground when the balloon was some miles distant. Cartridges were also fired from the balloon itself. These experiments demonstrated that explosives can readily be fired at a considerable distance by means of Hertzian waves; that, however, with proper precautions, wireless signaling can be carried on in the neighborhood of such explosives even though these are in a condition to be fired by more Hertzian waves than are used for the signals. Another note refers to the experiments now in preparation to use wireless telegraphy in the next manœuvres of the English navy. The first-class cruiser Europa is being supplied with the Marconi apparatus. Marconi has taken up his quarters on the Juno, which vessel, together with the Diana, is equipped with the wireless telegraph system.—Lond. *Elec.,* July 28.

Thunderstorm and Wireless Telegraphy.—Martin.—A communication on some observations made during a recent thunderstorm with a coherer consisting of brass filings, which had been exposed to air for four days and nights, and an unexhausted tube. When this was connected in series with a single Leclanché cell, a telephone receiver and a galvanometer, a 50-foot vertical wire being used, very distinct readings were obtained; the galvanometer, which was not at all sensitive, often being deflected 80°. A large number of readings were obtained when there were no visible flashes; but when a visible flash did occur, an instantaneous effect was shown in the instrument. Earth connection was superfluous, but no results were obtained without a vertical wire.—Lond. *Elec. Rev.,* July 28.

Wireless Telegraphy.—A short note on some experiments made between Fiume, Abbazia and Pola. The features of interest are that instead of the Marconi coherer, a new form known as the Schaefer coherer was used; (this from a previous description seems to consist of a filament of silver on glass, the filament being divided into two parts by means of a fine scratch; see *Elek. Anz.,* July 8). The other feature of interest was that the experiments were successful up to a distance of about 37 miles without the use of the vertical wires which seem to mave been so important an element in the Marconi system. The note contains practically no further information.—*Elek. Anz.,* July 16; *Elek. Zeit.,* July 20.

Railway Signals.—Bassanta.—A short note on his automatic system of electric signals which is claimed to have been used with success on a certain line. It seems that those in charge of the train are informed automatically if there is another train on the same block or if there is an interruption of the line; signals are also given at cross points and the locomotive driver is in telephonic communication with the stations; the speed of a train can be determined at each station by the periodic noise made by the connecting rod of the locomotive, presumably by the action of the microphone carried on the locomotive. The system itself is not described.—*Elek. Anz.,* July 16.

REFERENCES.

Wireless Telegraphy in the English Navy.—A short note stating that experiments are to be made to ascertain the utility of wireless telegraphy for the navy.—Lond. *Elec.,* July 21.

Multiplex Telephony.—Schwensky.—A reprint of the English translation of his article mentioned in the Digest, Aug. 5.—*El'ty.,* Aug. 2.

Wireless Telephony.—A short note stating that two successful attempts to invent a wireless telephone are reported to have been made, one by Dr. Peter Steins, of Russia, and the other by Mario d'Ossar, an Italian. No particulars are given.—Lond. *Elec.,* July 28. The invention of Steins is mentioned also in Lond. *Elec. Eng.,* July 28.

Telephone Practice.—Miller.—An illustrated article on capacity tests.—*Amer. Elec.,* August.

Block System.—Walzel.—An illustrated description of the block system used on two portions of the single track railway in Austria, for trains running in the same or in opposite directions.—*Elek. Zeit.,* July 27.

MISCELLANEOUS.

Lightning Conductors.—McAdie.—Portions of a bulletin issued by the U. S. Weather Bureau; it is of a practical nature giving a summary of the present knowledge on the subject. There is no doubt that lightning rods are efficacious; the chief defects are blunted points and breaks in the continuity; it has two functions, that of conducting the charge to earth and that of preventing a disruptive discharge by silent neutralization. He explains the difference between the path of least resistance to a steady current or to an impulsive rush; he considers the report of the Lightning Rod Conference in 1882, an excellent one. The following directions are given concerning lightning rods; all barns and exposed buildings should have rods, but there is no such need for them in the city blocks; a copper rod should weigh about 6 oz. to the foot and be preferably in the form of a tape; iron seems to be as efficient and should weigh about 35 oz. to the foot; the nature of the locality will to a great degree determine the need for a rod; the best ground connection possible is none too good; the earth plates should be in damp earth or running water; connect the conductor to any water or gas mains near it; connect any two metal ramifications that are close to each other; the neighborhood of small bore fusible gas pipes and indoor gas pipes in general should be avoided; the points of the rods should be protected from corrosion; independent grounds are preferable to water mains; clusters of points or groups of two or three are recommended; chain or link conductors are of little use; there is no such thing as a definite protected area depending on the height of the rod; the discharge should be considered as oscillating; the path of a discharge will depend largely on the character of the flash; any part of a building may be struck whether there is a rod on it or not, or below the rod, but these are exceptional cases; buildings may be damaged without being struck, as they may be set on fire by induced sparks near escaping gas; it may make little difference whether the trees are higher than an adjoining building; do not stand under trees, nor chimneys or fireplaces in a thunderstorm, but there is no sense in insulating oneself; small articles of steel do not have the power to attract lightning; the meteorological conditions attending lightning sometimes causes depression; when a person is struck by lightning one should at once try to restores consciousness by the usual methods, which he describes.—*West. Elec.,* July 29.

The question of whether it pays to provide protection is discussed in a briefer abstract which also contains some of the statistics concerning losses. To furnish protection to buildings of all classes would be a losing investment; for cheap buildings it is cheaper to rely on insurance; with church spires and high brick chimneys the value of the property endangered is generally considerable, and as they can be protected with great certainty and at small cost, such protection is advisable.—*Eng. News,* Aug. 10.

Utilization of Atmospheric Electricity.—A note referring to an opinion expressed by Prof. McAdie, of the U. S. Weather Bureau, that it should not be long before the electricity of the atmosphere could be utilized for operating machinery. Editorially it is stated that in many agricultural districts of France there have been erected what are known as geomagnetiferes for collecting atmospheric electricity with a view to its distribution through the soil as a fructifier, experiments having proved that electricity obtained in this way has the peculiar property of stimulating the growth of plants; the collector consists of a high pole surmounted by a crown of copper spikes insulated from the shaft by a porcelain knob, a conductor is connected to the spikes and leads the current wherever desired. The mechanism employed by the Weather Bureau for determining the presence and amount of electricity in the atmosphere is also described. A gauge provided with an aluminum needle attached to the wire conductor of a box-kite, registers at the surface of the ground the amount of electricity present in the atmospheric layer in which the kite is flying.—*El'ty,* Aug. 2.

Purification of Sugar by Ozone.—Verley.—A long abstract of a paper. He describes his apparatus, which has been used since 1896 commercially in a factory near Paris for the manufacture of vanilline and other organic products. A plate of aluminum is placed on one of slate, both having a hole in the middle for letting out the ozonized air; on this are placed rectangular rods of glass 3 to 4-mm in height, and the whole is covered by a plate of glass silvered on the outside surface; the glass rods are so arranged as to form a rectangular spiral channel, the air entering at the outer end, passing a long distance through this channel over the aluminum plate and leaving at the hole in the centre; this silver coating and the aluminum plate are connected to a Hertzian oscillator, which he finds gives a better effi-

ciency than a mere transformer, owing to the higher frequency. The advantages of this apparatus are claimed to be that it can be made of large dimensions, that the two plates may be absolutely parallel, it can be easily taken apart, cleaned and dried of the moisture which may form; it has a large cooling surface, the temperature rising only 4° or 5° C. An industrial application for treating sugar was made at Moyan; the installation is for treating 200 tons per day; the alternator generates 300 amperes at 250 volts, that is, about 100-hp; the current is divided into 10 circuits each having its transformer, the secondary voltage of which is 12,000, and each one operates 10 ozonizers, there being therefore 100 in all. The refining takes place in winter, and therefore no artificial cooling is necessary; the ozonized air is freed from the nitrogenous products which are also formed; the ozonized air is well mixed with the solution of sugar in tanks and is left in contact with it as long as possible; that which comes out of the first tank is passed into the second, which more efficiently utilizes the ozone; there are three tanks, two of which are in series while a third is being emptied or filled; each contains 70 hectoliters; the temperature should not exceed 20° C., for above that, the ozone attacks the sugar; the syrup should have an alkalinity of 1 to 0.5 gr. of chalk per liter; the action is stopped when the color is restored to that which it had first. The ozone is said to bring about complete combustion of certain organic materials, the sugar remaining unaltered providing the temperature is not too high or the action of the ozone too prolonged; the degree of purity is increased; besides oxidizing completely some of the substances, important modifications of other materials in the syrup are said to be produced; a subsequent treatment is also required. The ozone treatment enables one to extract from beets, a larger quantity of crystallizable sugar, by diminishing the proportion of molasses; the odor of the beets is eliminated entirely from the sugar, which then has a more agreeable taste, resembling that of cane sugar. For the ozone treatment about ½-hp is required per ton of beets.—*L'Elec.*, July 8.

Röntgen.—Prof. Röntgen, of Wuerzburg, Germany, has been elected to the chair of physics of the University of Munich, formerly occupied by the late Prof. Lommel, and will accept the call.—*Elek. Zeit.*, July 27.

New Books.

CHIMNEY DESIGN AND THEORY. By William Wallace Christie. New York: D. Van Nostrand Company. 164 pages, 41 illustrations. Price, $3.00.

When one considers how important a part the chimney plays in the economy of a steam, and consequently an electric plant, constituting in a sense the lung of the generating system, it must be conceded that its correct design and construction deserve careful and serious consideration. On account of the many intricate problems involved and the necessity for the correct employment of numerous principles, the art of chimney design has narrowed down of late to a special branch of engineering. The data relating to it, however, have accumulated so rapidly that their collection and classification has been a task not attempted within the last fourteen years—that is, since the appearance of Bancroft's work in England and a somewhat later treatise on chimney draft by Idell, in this country.

To fill this important gap in technical and engineering literature has been the problem which confronted Mr. Christie, and he appears to have solved it in a creditable manner. The author has carefully collected and sifted most of the available data on chimney design and theory, and has tabulated and illustrated many examples of modern construction practice. The most reliable and accepted authorities are cited, and the extracts from handbooks, catalogues and trade literature in general are the results of experimental researches. The author has injected but few personal opinions, and does not enter into discussions as to the merits of different methods and designs. This is to be regretted, as is also the little space which is devoted to a discussion of natural vs. mechanical draft, in view of the growing importance of the latter system. The book, which abounds in valuable tables and diagrams, is well indexed, printed and illustrated.

It is divided into eleven chapters dealing with the subject as follows: Introduction and history; theory of chimney draft; chimney formulæ; chimney tables; wind-pressure; air space in grates; foundation materials and brick chimney materials; steel chimneys, theory pertaining to the same and examples from existing structures; brick chimneys, theory pertaining to the same and examples; chimney performances; special types; straightening chimneys; flues, house chimneys; lightning protection; general information.

DIAGRAMS AND HANDBOOK FOR TELEGRAPH ENGINEERS. Pocket Edition. By Willis H. Jones. Diagrams by W. A. Van Orden. New York: J. B. Taltavall. 115 pages, numerous diagrams. Price, $1.00.

The purpose of this book, as stated by the author, it to place before telegraphers a pocket edition of diagrams which shall take the place of the incomplete and more or less inaccurate drawings which nearly every chief operator and lineman carries with him. In this he seems to have been successful; and although the value of much of the "useful information" always considered indispensable in such a book may be questioned, it need not bother the user. The diagrams are clear, and altogether it is a handy little book, useful to the engineer as well as to the lineman and operator.

TELEPHONES; THEIR CONSTRUCTION AND FITTING. A Practical Treatise on the Fitting Up and Maintenance of Telephones and the Auxiliary Apparatus. Fifth Edition. By F. C. Allsop. London: E. & F. N. Spon, Limited. New York: Spon & Chamberlain. 184 pages, 156 illustrations. Price, $1.25.

This book of Mr. Allsop's is professedly written for the fitter and the "practical electrician," its object being "to deal with the erection and working of telephones for private lines and small private exchanges." We must not look, therefore, for details of the working of public exchanges, instructions covering the erection and working of long lines or a discussion of their characteristics. The text is devoted to a description of the instruments most used in England, among them the familiar Blake transmitter and the modern Hunnings; detailed explanations of the working of "switch bells," instructions to linemen for moving outside wires, for wiring up small private systems and for finding "trouble," and one brief chapter on the working of a public exchange. The cuts are abundant, but some of them savor rather too strongly of the illustrated catalogue of the manufacturing electrician. Views of the outside of walnut boxes and metal stands, labeled as various wall and desk sets, are not very instructive. There are, however, in addition to these, inside views and sections of a few of the important instruments, and very full diagrams of a number of arrangements for private lines.

The directions for the kind of outside work known as "house-top" construction are very elaborate. This seems a pity, for such work is wrong; and although no doubt it is quietly and privately done in many cases in this country, it is, as it should be, officially discountenanced. Another minor point which strikes the American reader —assuming, of course, that the instructions represent prevailing English practice—is that the English construction men have not yet learned how to dig post holes or to set poles. In spite, however, of the difference of practice and a few such faults as have been pointed out, the American fitter will find much of interest and value in the book. Probably, in spite of all temptations, the English artisan will remain true to his individuality and his national instincts, but we expect more flexibility and docility in the American.

CONSTRUCTIONSTAFELN FUR DEN DYNOMOBAU. By Prof. E. Arnold. Two portfolios, 16 x 21 inches. Portfolio I, 64 drawings of direct-current machines. Portfolio II, 48 drawings of single and polyphase alternating-current machines and transformers. Stuttgart; Ferdinand Enke. Price, each portfolio, 20 marks.

Portfolio No. 1 contains 64 sheets of dimensioned designs for direct-current apparatus, generators, motors and details of the same. The designs show excellent draftsmanship, and will be very useful to dynamo builders and all interested in dynamo construction. They represent the types and details of machines constructed in Europe by a number of the leading manufacturers.

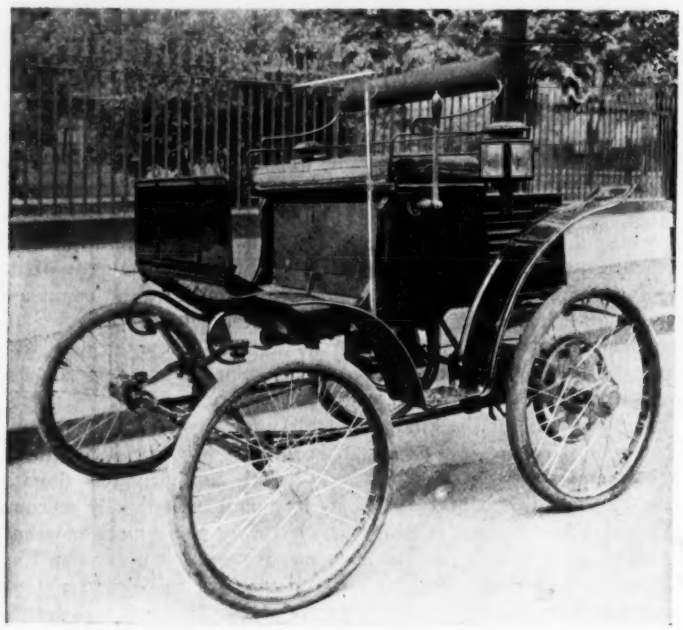
Portfolio No. 2 contains 48 sheets of designs for alternating-current apparatus, alternators, motors and transformers—single-phase and polyphase. All dimensions are clearly shown, and the designs would serve as the basis for detail working drawings. These drawings serve to give the electrical engineer accurate ideas as to the manner in which electrical machinery is constructed in Europe.

DIE SICHERUNGEN VON SCHWACH- UND STARKSTROMANLAGEN GEGEN DIE GEFARHEN DER ATMOSPHARISCHEN ELEKTRICITAT. (Protection of Low and High-Tension Central Stations against the Dangers of Atmospheric Electricity.) Von Friedrich Neesen. Braunschweig: Friedrich Vieweg & Sohn. 120 pages, 126 illustrations. Price, 5 marks.

This is a copiously illustrated little volume describing, for the benefit of practical electricians, and without unnecessary theory, the various apparatus which has been, and is now, in use for the protection of electric circuits against lightning. The first two sections are devoted to low-pressure circuits, and the next three sections to high-pressure circuits, the remaining two sections being devoted to special and experimental cases. The cuts are excellent, and the descriptions are clear. The apparatus described relates to lightning protectors used in telegraphy, telephony and the transmission of power, not only in Germany, but also in America and Europe generally. The book should be useful to the electrical public as a compilation, and to the student as an excellent practical study.

The Riker Runabout.

A type of automobile for which the Riker Electric Vehicle Company have experienced a large demand since their exhibit at Madison Square Garden, and based upon the lines of the one offered by the management of the Electrical Exhibition for the most popular actress, is shown in the accompanying illustration. It is one of the neatest,



AN ELECTRIC RUNABOUT.

prettiest and handiest rigs imaginable. It weighs only 1100 pounds and carries two passengers very comfortably. It has a wheel base of 50 inches and a tread of 48 inches, and the wheels are fitted with pneumatic tires. There are two motors of ¾-kw each, and the battery furnishes a capacity for 25 miles on level macadam with each charge; a maximum speed of 12 miles an hour being possible. The controller gives three speeds ahead and two to the rear. The driving is done from the rear wheels and the steering by the front wheels. The driver is supplied with indications of the state of the battery by the Riker combination voltmeter and ammeter put in front of him on the footboard and there are electric side lights. Altogether the vehicle commends itself to good taste and to the most expert engineering criticism.

The Riker Electric Motor Company, which has hitherto built all of Mr. Andrew L. Riker's apparatus, has now transferred all its property, assets, patents, etc., in accordance with plans previously announced, to the Riker Electric Vehicle Company, whose new factory at Elizabethport is now prepared for active work, and will have a capacity of from three to five complete vehicles a day. Mr. Riker's work in the automobile field thus enters upon a new and very interesting stage of development.

Columbian System of Electric Lighting and Ventilation for Railway Cars.

Some months ago we printed a description in full detail of the Columbian electric lighting system for steam railroad cars. As the mechanism has since then been considerably improved, we give herewith some views of the latest type of apparatus.

In this system the generator is driven by gearing from a car axle. Each car has its own generator, as well as a storage bat-

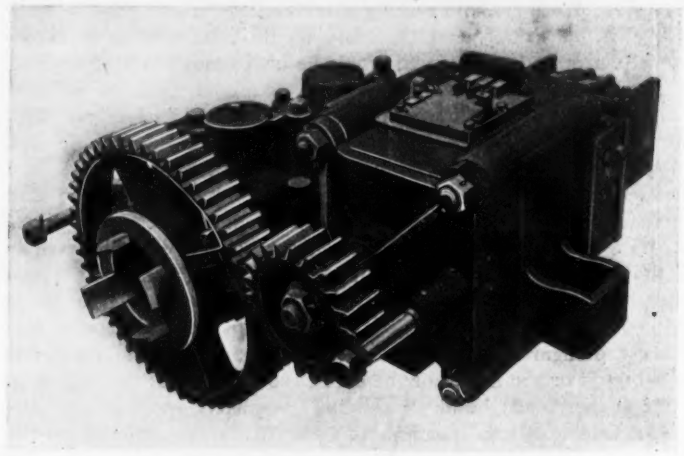


FIG. 1.—END VIEW OF GENERATOR.

tery to supply current during stoppages and at times of abnormally slow speed.

The generators are standardized, and provisions made for fitting them to any ordinary car axle, turned or unturned, by means of a split sleeve and chuck jaws, which latter grip the axle, and are adjustable to permit of exact concentricity of the motor bearings with the axis of the axle. Fig. 2 shows the mechanism whereby the direction of the current from the dynamo is changed in case of change of motion of the car, thus enabling the battery to be charged regardless of the direction of motion. As will be seen, this is accomplished by means of a worm on the armature shaft, which engages a gear, which in turn actuates a pole-changing switch.

The generator, which is shunt-wound, is excited from the storage battery, the exciting current being regulated to the speed of

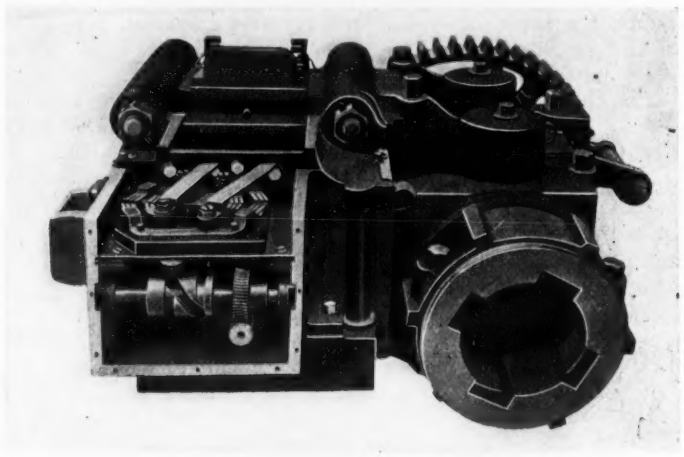


FIG. 2.—POLE CHANGER.

the armature by a rheostat in the shunt circuit, which cuts resistance in or out as the speed of the car increases, thus keeping the e. m. f. constant. The rheostat is automatically operated by a pawl mechanism, the pawls being constantly kept vibrating by a small motor; one pawl or the other is made to engage with a ratchet turning the rheostat arm by the action of an electromagnet in the armature circuit. In connection with this regulating arrangement is another actuated from the same electromagnet, whereby resistance is thrown into the lamp circuit when the dynamo is charging to compensate for the rise in battery e. m. f., which then results. There is also a cut-out switch to disconnect

the battery from the generator when the car stops, or the speed falls below a certain minimum.

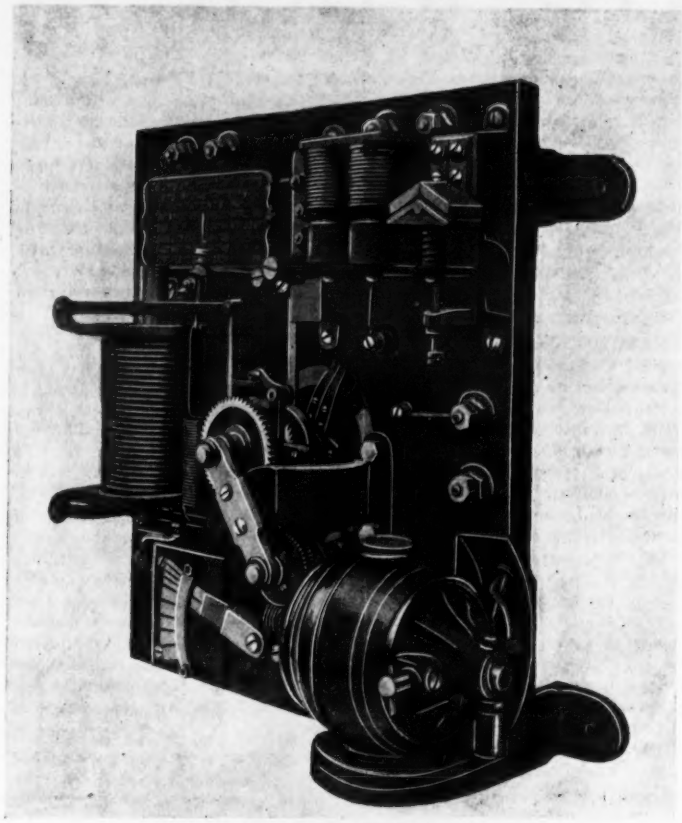


FIG. 3.—REGULATOR.

The operation of the devices as a whole is as follows: Assuming that the train is running below normal speed, the lights will be supplied direct from the storage battery, getting its full e. m. f., and the machine is cut off from the battery by the automatic switch. As the speed rises, the automatic switch closes, the current flows through the solenoid which attracts its armature, engaging the pawl which turns the main shaft in such a direction as to cut resistance into the field circuit to limit the charging current, as well as into the lamp circuit, to take up the increased electromotive force of the cells. More and more of these resistances are cut in as the speed and charging current rises.

As will be seen, the system is absolutely automatic, no attention being required on the part of the train operatives. The load on the machine is kept constant, a resistance replacing a lamp or fan motor when one is turned off.

The Columbian Company states that it has the system in operation on some of the most important railroads in this country and Canada—the New York Central, Pennsylvania R. R., Baltimore & Ohio, Union Pacific, Pennsylvania lines west of Pittsburg, Canadian Pacific, and it is ventilating and lighting the cars of these roads to perfection.

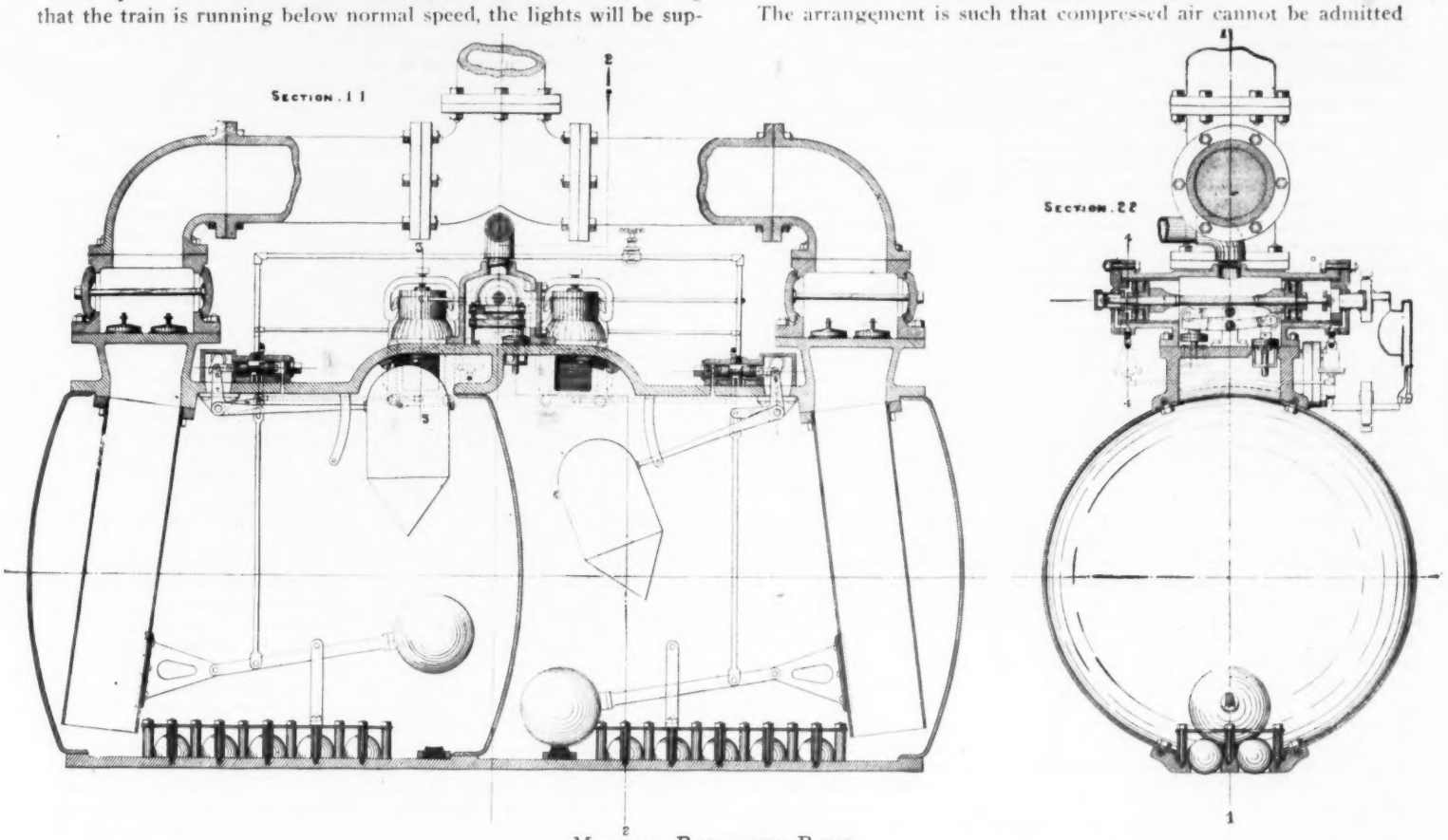
Compressed Air Displacement Pump.

The accompanying illustrations show in sections a new type of compressed air displacement pump, known as the Mitchell pneumatic pump.

Water is admitted through the inlet valves shown at the bottom of the cylinder, and when all the space is filled it is forced by compressed air through the discharge pipes extending to near the bottom of the cylinder. There are two systems of valve mechanism, one of which, controlled by the floats shown near the top and bottom, admits compressed air to work the other, or main water and air valves. The pumps is double acting, one side of the cylinder filling while the other is being emptied.

As the level of the water approaches the bottom, the lower float falls, and at its lowest position actuates the primary valve, which, in turn, actuates the main air valve, whereby the compressed air remaining is exhausted, and the cylinder commences to refill with water. When the level of the water approaches the top, the upper float is lifted and in its uppermost position actuates the primary valve in the opposite direction, thus admitting compressed air to force the water out through the discharge pipes.

The arrangement is such that compressed air cannot be admitted to the water until the cylinder is entirely full, thus doing away entirely with clearance. In case the pump should empty faster than it fills through a high air pressure being used, the valves will shut off the supply of air until the cylinder fills, thus obviating any waste of air. The pneumatic pump described is made by the Hawley Downdraft Furnace Company, Superior and Townsend Streets, Chicago, Ill.



MITCHELL PNEUMATIC PUMP.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—The course of affairs in the stock market has been neither lively nor rapid. There has been doubt as to the price for money, but the week closed with a favorable bank statement, and on the whole it looks as though the reserves were to be increased rather than depleted, in spite of the fact that heavy crops have to be reaped, garnered and shipped. At the close of the week, the uncertainty that had prevailed crystallized suddenly and sharply into a buying and covering movement, which left stocks firm and strong, with a possibility of a bull campaign near at hand. Mr. J. R. Keene says that stocks are now as high as they ought to be, but the splendid state of trade and the current railroad earnings belie his words. Prices may possibly go higher on intrinsic values before they go lower. During the week 2068 shares of Western Union were sold, closing at 90, and 1541 of General Electric, closing at 124½. Brooklyn Rapid Transit was dealt in to the extent of 66,000 shares, closing at 114¾. Metropolitan Street Railway, on very small dealings below 8000 shares, closed at 209. Manhattan Elevated is strong on talk of electrical equipment, and on sales 12,230 shares closed at 117⅞. In Boston American Bell Telephone closed at 345; Erie Telephone, at 97½; Boston Elevated, at 108¾, and West End preferred at 113. In Philadelphia, Electric Storage Battery closed at 150-151, and preferred at 153-153¾. Philadelphia Traction was quoted 99½, and Union Traction at 42 to 42¾. Electric Company of America was 18; National Electric, 13⅞, and Pennsylvania Manufacturing Company, 27½. General Electric Automobile sold at 8 to 8½. In Chicago, National Carbon common sold at 23¼ to 24, and preferred at 86; Chicago City Railway at 41, bonds at 101¾, and Union Loop, 5s. at 110. In the New York unlisted department, Electric Boat common sold at 17 to 20, and preferred at 39 to 44. Electric Vehicle Company common sold at 97 to 100, and preferred at 115 to 123. New York Electric Vehicle Trans. at 24 to 24½; New England Electric Vehicle Transportation at 9½ to 10¼; Illinois Electric Vehicle Transportation at 5¼ to 5¾; General Electric Automobile, 17 to 24; General Carriage Company, 34 to 37. National Tube Company stock made its appearance. The subscriptions, which carry 100 shares of preferred and 50 shares of common were bid for at 111½, and offered at 112½. The common stock was bid for at 28, none offered. A good deal of the company's product is now used for interior and underground conduits.

AMERICAN BELL TELEPHONE.—In discussing the affairs of this important company, the Boston News Bureau says: "The American Bell Telephone Company, up to a recent date, owned a majority control of the stock of 29 subcompanies and a minority ownership in 18 sub-companies. There have been a number of consolidations in the telephone field of late, and it is evident that the policy of the American Bell Telephone Company is to secure majority control of companies in which it at present owns only a minority interest. Five of the companies are possibly beyond Bell control, as they are controlled by the Erie Telephone Company, namely, the Cleveland Southwestern, Northwestern, Wisconsin and Michigan companies. The New England Company has recently absorbed the Southern Massachusetts and the Vermont companies, thus removing two companies, and is said to be after the Providence & Southern New England, in which the Bell has only a minority interest. Up to a recent date it did not control the Cumberland Telephone & Telegraph Company, one of the most important and growing of the Bell companies operating in the central Southern States (Kentucky, Tennessee, Louisiana and Mississippi). This company, however, recently doubled its capital stock and absorbed the Ohio Valley Telephone Company, which is controlled by the Bell, and stock was taken by the Bell Company instead of cash, thus allowing Bell people to control the Cumberland Company. The Bell Company also recently secured control of the Cincinnati Telephone Company, in which company it previously held but 35 per cent. of the stock. Under Bell control the Cumberland Company has been buying up independent exchanges throughout its territory, which it has been able to do at prices far below their original cost.

SAULT STE. MARIE POWER.—Orvis Brothers & Co. announce that they offer to investors at par and accrued interest $500,000 fifty-year 5 per cent. first mortgage gold bonds of the Michigan Lake Superior Power Company, incorporated under the laws of the State of Michigan, being the unsold part of a total issue of $3,500,000, secured by a first mortgage on all the real estate now owned or which may hereafter be acquired in the City of Sault Ste. Marie by the Michigan Lake Superior Power Company, and also upon the hydraulic development of 60,000 horse power under construction upon a portion of the real estate. Also upon all rents, revenues and franchises accruing to the company. The proceeds of the entire issue of $3,500,000 bonds are being used in payment for real estate, and to cover the cost of completion of construction of the hydraulic power development, which is to be fully completed next spring. The hydraulic power has already been leased to responsible tenants for a period of twenty-five years, which will yield the company annually the sum of $537,500, and as additional security to the bondholders and to insure the payment of interest one of these contracts yielding an annual rental of $200,000 has been assigned to the Provident Life and Trust Company, trustee for this issue of bonds. The financial statement of the company shows a surplus of $312,500 after payment of interest and expenses.

KANSAS CITY RAILWAY BONDS.—Two-thirds of the $1,500,000 issue of first mortgage bonds of the Central Electric Railway Company, the name of the consolidated Northeast and Brooklyn avenue lines, has been sold, and negotiations are pending for the sale of the remaining half million. The Central Electric Railway Company has a separate set of officers and directors, but its stock is controlled by the Metropolitan Street Railway, of Kansas City, and its lines are a part of the Metropolitan system. The bonds are guaranteed by the Metropolitan Company, and they have been sold in Chicago, New York and London at an average of 100¾. P. A. Valentine of Chicago, confidential man of P. D. Armour, and president of the Board of Directors of the Metropolitan Company, negotiated the sale. London concerns invested one-half a million dollars in the bonds. The price at which the bonds sold is considered high. The new company is not known in the market, and it has not demonstrated its capacity to earn money. But the Metropolitan Company's assets are behind the Central Company's bonds, and Metropolitan bonds are worth 107 or 108. The bonds were issued to pay for the rebuilding of the Northeast & Brooklyn avenue lines. They are dated May 1, 1899, they run fifteen years and draw 5 per cent. interest. The purchasers have agreed to pay the accrued interest from May 1.

GENERAL LIQUID AIR COMPANY.—The General Liquid Air and Refrigerating Company, which was formed a little more than a year ago, has been reorganized and its capital stock increased from $300,000 to $10,000,000. It is expected that this new organization will be completed in all of its details within the next four or five weeks. Its headquarters will be in this city, and it will sublet the right to make liquid air in other states. About a year ago the original company built a plant here for the purpose of demonstrating the efficiency of the Ostergren-Burger process of manufacturing liquefied air. S. W. Vandivert, of the law firm of Gardenhire & Vandivert, who has had charge of this reorganization, said last week that it was the purpose of the new company to construct a plant in this city with a capacity of producing several thousands of gallons of liquid air a day. The new organization has a basic patent in this and thirty foreign countries. The plant built to test the Ostergren-Burger process has a capacity, it is boldly alleged, of producing 1500 gallons of liquid air a day at a cost of but five or six cents a gallon. The efficiency of Ostergren's invention over other processes is claimed to be due to a fundamental difference in the liquefier which enables the air to be produced very cheaply. The first call for $500,000 on the stock of the General Liquid Air and Refrigerating Company has been made.

AMERICAN AIR POWER COMPANY.—Many rumors in regard to the American Air Power Company were heard last week. It was said that Mr. William C. Whitney's return from Europe would be followed by important developments in its affairs, and among these developments was mentioned the probable formation of a larger company that would absorb the American Air Power Company. It was said that the new company would be called the United States Air Power Company, but just what companies were to form the new combination was not stated, and no confirmation of the report could be had. Reference to the adoption of the American Air Power Company's cars on the crosstown lines of the Metropolitan system has many times been used to influence American Air Power stock, but there seems to be nothing new in this connection, nothing that has not been generally known for some time past. Altogether the recent violent advance in American Air Power seemed due chiefly to heavy manipulation of the stock, which so far has represented air and little else.

WESTERN UNION.—One of the Wall Street financial organs says: "There is a small but confident short interest in Western Union. Stock sold three months ago has not been covered, and the sellers seem content to wait. Some of them, indeed, have orders to sell Western Union on a scale up if the price should advance. We think this selling grows out of knowledge that the company has not participated in the improvement in business during the last few years. The reports have shown the dividends earned, but the margin has been very narrow. It is certain that the advance in copper has added considerably to the required outlay for construction and maintenance, and up to the present quarter the company has only about held its own in net revenues. We are told that the matter of reducing the dividend to a 4 per cent. basis has more than once been informally discussed by the management, and that the discussion was quite active at the time the last dividend was declared. It seems not unlikely that the matter may come up again at the meeting in September. Should it be thought wise to reduce the dividend the price would probably be affected somewhat, as the stock is largely held by investors, who would regret to see their incomes reduced." This looks rather like part of an effort to depress the stock.

CONTROL OF THE BROOKLYN FERRIES.—Rumors that the Brooklyn Rapid Transit Company was negotiating for the control of the Union Ferry Company and the Brooklyn Ferry Company have been current for some time, and gained some strength in Wall Street in consequence of the advance in price of the stock of each company. The market quotation of the Union Ferry stock rose from 42 to 45 some days ago, and Brooklyn Ferry stock advanced three points, going from 37 to 40. A representative of the Brooklyn Rapid Transit Company said that there was no truth in the reports that the ferry properties were to be acquired by that company. He said that the question of a traffic arrangement between the Brooklyn Rapid Transit system and the Union Ferry Company had been broached, but nothing agreed upon. The Rapid Transit management has signified its willingness to make closer and more frequent connection with the South and Hamilton Ferries. The Union Ferry Company is capitalized at $3.000,000, and the Brooklyn Ferry Company at $15,000,000. Both of these stocks have been uncommonly active in Wall Street recently.

ST. LOUIS POWER, LIGHT & TRANSIT.—A St. Louis paper published last week a statement to the effect that the United Railways Company, which is controlled by the syndicate formed by Brown Brothers & Co. of this city, was to acquire control of the Missouri Edison electric light plant and of various electric, gas and water works. James Brown, of Brown Brothers & Co., said that no such move had been made by the United Railways Syndicate. The syndicate now controls all the street railways in St. Louis except one line, the Consolidated, and provision had been made for the acquiring of this property. Mr. Brown was sure the St. Louis water works could not be acquired, since

they were owned by the municipality. As the combination was a railroad one, pure and simple, it was not probable that the absorption of electric or gas companies was contemplated.

BOSTON EDISON COMPANY.—An increase in the capital stock of the Edison Electric Illuminating Company, of Boston, is proposed, as stated in this column last week, and application has been made to the gas commissioners for authority to issue $750,000 new stock, which will bring the company's outstanding capital up to $4,670,000. As soon as the authority of the gas commissioners has been obtained, a special meeting of the stockholders will be called to ratify the same. Proceeds of new stock are to be used for new construction, general additions and improvements. On April 3 last the stockholders were offered the right to subscribe to 1702 shares at $120 per share.

MASSACHUSETTS ELECTRIC COMPANIES.—Officials of the Massachusetts Electric Companies confirm the purchase of the Taunton & Brockton Street Railway Company, which operates 13 miles of road between Brockton and Taunton. It is capitalized for $100,000 stock and $100,000 5 per cent. bonds. It was the original intention to take over this road, but leading stockholders asked $50 per share more than Massachusetts Electric people would pay, and the trade fell through. The stockholders have now agreed to the Massachusetts Electric Companies' price, at which figure it is considered a valuable acquisition.

NEW YORK ELECTRIC BRAKE & COUPLER.—A suit has now arisen over recent dealings in this mysterious stock, the plaintiff alleging that he was swindled out of $16,000 by being induced to buy the stock for the defendant's account. The plaintiff is a Denver broker, who executed his client's order in good faith on small margins, and, he says, "got stuck," because no further money was forthcoming, and the stock bought was worthless. How some of these stocks get dealt in at all, even "on the curb," is a marvel.

CHICAGO UNION TRACTION.—The Chicago Union Traction Company is earning at the rate of 3 per cent. on common. Dividends on preferred will begin in October at the rate of 5 per cent., or at the rate of 1¼ per cent. quarterly. The leases of the companies operated by it run from June 1, but it did not secure control until July 1. Earnings for July were $40,000 more than for the same month last year. For the first eleven days of August they were $22,000 more than for the same time last year.

BOSTON ELECTRIC LIGHT COMPANY.—At the annual meeting of the Boston Electric Light Company the stockholders authorized an issue of 5000 shares of new stock, which brings the total capital up to 30,000 shares, or $3,000,000. Between 14,000 and 15,000 shares were represented at the meeting. The gas commissioners have yet to pass upon the matter, but no date has been set for a hearing. Details as to the use of the increase were given in this column recently.

THE SCOTT-JANNEY ELECTRIC COMPANY, capitalized at $30,000,000, was incorporated at Trenton, N. J., on Aug. 14. The company is organized to build and operate electric railways, and its principal office is at Camden. The stock is divided into 600,000 shares at $50 each, one-half preferred, bearing an annual dividend of 7 per cent. non-cumulative. The incorporators are Frank R. Hansell, William Eidelf and George H. Martin, all of Camden.

BROOKLYN DISTRICT TELEGRAPHS.—A certificate of reduction of the capital stock of the American District Telegraph Company of Brooklyn from $200,000 to $100,000 has been filed with the New York Secretary of State. The amount of capital stock paid in is $100,000, and the total amount of debts and liabilities is $1000.

WESTERN ELECTRIC COMPANY has filed a certificate as to the increase of its capital stock from $3,500,000 to $8,000,000. It is extremely busy, and has been enlarging all its facilities. Several new Bell telephone exchanges wait on its ability to furnish the switchboards for them.

Commercial Intelligence.

THE STATE OF TRADE.—During the past week business affairs in general have worn the bright complexion assumed ever since the summer began, so that even at the height of the ordinary dull season and at a time when energies are usually relaxed, the industrial activity of the nation has barely been intermitted at all. As a matter of fact, it would be better if the strain were less constant and insistent, and if the pace were reasonably slackened, but when urgent orders pile up and are repeated, the only thing to do is to try to fill them. Many electrical manufacturers this summer have happily found a steady, brisk demand for their output, and have even grudged the ordinary cleaning up period. If reports are to be depended on, the proposals in hand average about ten times the capacity to fill them, so that allowing for duplication, it would seem that there is plenty of work to go around for all concerned. There continues considerable inquiry for power plant apparatus, and the quantity of Government work in sight is large. Prices might be better, however, in view of the steady maintenance of the high cost of raw materials. General trade conditions are excellent. The total July earnings of 105 railroads show a gain of not less than 17 per cent., and for seven months 107 roads show a gain of 8.2 per cent. over last year, itself a good period for earnings. The July production of pig iron was the largest ever known. The fall demand in dry goods and other articles of consumption is remarkably brisk and increasing. Cotton is higher on crop deterioration reports, but the corn crop report is most favorable, promising 2,200,000,000 bushels, but its price stays up. Bank clearings show a gain of 24.3 per cent. over a year ago.

ELECTRICAL EXPORT TRADE.—We are now able to give the full figures for the year ending June 30 of the electrical export trade of this country. The total of electrical machinery reached the respectable amount of $2,736,110, as compared with $2,052,564 last year. This is, however, but part of the export, and there is an extensive trade in telegraph, telephone, power and electric light supplies, etc., all of which are grouped under instruments and apparatus for scientific purposes. The amount in this class for the year ending June, 1898, is $3,399,180, as compared with $2,770,803 in the previous year. A splendid showing all around is thus made. That the current year bids fair to keep up the pace is shown by the following list of exports of electrical material from the port of New York for the week ending Aug. 8: Antwerp, five cases electrical material, $655. Argentine Republic, 165 cases electrical material, $13,076. British possessions in Africa, 123 packages electrical material, $8,036. Brussels, 3 cases electrical material, $150. British Australia, 28 packages electrical material, $1,446; 22 packages electrical material, $574. British East Indies, 13 packages electrical material, $315. British West Indies, 2 cases electrical material, $78; 35 packages electrical material, $560. Berlin, 17 packages electrical material, $3,023. Brazil, 3 cases electrical material, $83. Cuba, 69 cases electrical material, $1,046; 4 cases electrical material, $110. Central America, 135 cases electrical material, $1,901. Dublin, 20 cases electric cable, $8,862; 4 cases electrical material, $245. Dutch West Indies, 4 cases electrical machinery, $90. Glasgow, 21 cases electrical material, $835. Hamburg, 22 packages electrical material, $1625; 11 cases electrical machinery, $2015. Havre, 3 cases electrical machinery, $200; 44 cases electrical material, $3651. Hong Kong, 4 cases electrical material, $60. London, 88 packages electrical machinery, $16,200; 136 packages electrical material, $7928. Marseilles, 25 cases electrical machinery, $1454. Newfoundland, 9 cases electrical material, $41. Rotterdam, 2 cases electrical material, $100. Southampton, 6021 cases electrical machinery, $320. United States of Columbia, 14 cases electrical material, $294; 3 cases electrical material, $54.

NEW OUTLETS FOR APPARATUS.—One of the interesting features of electrical work to those who watch it closely is the manner in which new outlets and new markets open up for apparatus, the cumulative or revolutionary effect upon the industry being quite marked. The telegraphic field of to-day has provided a large market for generators and dynamotors, and now the telephone field, with its recent centralized battery system, is giving new opportunities to the storage cell. The Electric Storage Battery Company has furnished a list of their customers for this new class of work, which will probably surprise many people by its length. There are few large concerns left out: American Telephone & Telegraph Company, Elmira, N. Y.; Pacific Telephone & Telephone Company, of Canada, Limited, Montreal; Bell Telephone Company, of Philadelphia; Central District & Printing Telegraph Company, Pittsburg, Pa.; Central Pennsylvania Telephone & Supply Company, Williamsport, Pa.; Central New York Telephone & Telegraph Company, Utica, N. Y.; Chesapeake & Potomac Telephone Company, Washington, D. C.; Cumberland Telephone & Telegraph Company, Nashville, Tenn.; Delaware & Atlantic Telegraph & Telephone Company, Philadelphia, Pa.; Empire State Telephone & Telegraph Company, Auburn, N Y.; New York Telephone Company; Hudson River Telephone Company, Albany, N. Y.; New England Telephone & Telegraph Company, Boston, Mass.; Northern New York Telephone Company, Plattsburg, N. Y.; New York & New Jersey Telephone Company; New York & Pennsylvania Telephonephone & Telegraph Company, Elmira, N. Y.; Pacific Telephone & Telephone & Telegraph Company, Elmira, N. Y.; Pacific Telephone & Tele- Pa.; Plymouth & Campton Telephone Exchange Company, Plymouth, N. H.; Providence Telephone Company; Southern Bell Telephone & Telegraph Company; Southern Massachusetts Telephone Company, New Bedford and Fall River, Mass.; Sunset Telephone & Telegraph Company, San Francisco; Troy Telephone & Telegraph Company, Troy, N. Y.; Southern New England Telephone Company, New Haven, Conn.; Bell Telephone Company, of Missouri; Central Union Telephone Company, Chicago Telephone Company, Colorado Telephone Company, Cleveland Telephone Company, City & Suburban Telephone Association, East Tennessee Telephone Company, Iowa Telephone Company, Missouri & Kansas Telephone Company, Michigan Telephone Company, Northwestern Telephone Exchange Company, Nebraska Telephone Company, Ohio Valley Telephone Company, Rocky Mountain Bell Telephone Company, Southwestern Telephone Company, Wisconsin Telephone Company.

SALES BY THE BULLOCK ELECTRIC MANUFACTURING COMPANY.—Among the more important sales made by the Bullock Electric Manufacturing Company during July are the following: Union Depot, Dayton, Ohio, two 50-kw engine type generators; Fuller Construction Company, New York City, four 50-kw engine type generators; Wilson Aluminum Company, Holcomb Rock, Va., one 60-kw belted generator; Warren K. Blodgett, Boston, Mass., one 150-kw belted generator, 450 r. p. m.; American Type Foundry Company, Cincinnati, 25 slow speed motors for direct connection to type machines; D. E. Whiton Machine Company, New London, Conn., one 30-kw belted generator; U. S. Government, San Francisco, Cal., one 30-kw engine type generator; Pullman Palace Car Company, St. Louis, Mo., one 12½-kw generator, one 25-kw engine type generator; *Daily Mail*, London, England, two 50-hp printing press equipments, including Bullock "teaser control" system; Aldrich Mining Company, Brilliant, Ala., one 30-kw belted generator; Missouri Lead & Zinc Company, Joplin, Mo., one 20-hp motor; Boston News Bureau, Boston, Mass., one 9-hp belted motor, 900 r. p. m.; Hanover Manufacturing Company, Bethlehem, Pa., one 10-hp belted motor; Southern Electric Company, St. Louis, Mo., one 12½-kw belted generator; Vulcan Metal Refinery Company, Sewaren, N. J., one 17½-kw belted generator.

INDUSTRIAL ACTIVITY AND CAPITALIZATION.—One of the features of the current commercial activity has been the tendency to combine and consolidate a number of concerns in any given industry, so as to effect economies in production and distribution, with consequent enhanced profit to the stockholders. But like every other good thing, this business may be overdone, and there are indications of a decided halt. Owing to the favorable laws and low corporation taxes of New Jersey that has been a centre and hotbed of consolidation, so that its figures may be accepted as thoroughly representative. At Trenton there were in the neighborhood of 90 companies incorporated in July. The aggregate amount of the capitalization of the companies capitalized at $1,000,000 or more is about $243,000,000, which compares with about the same amount in June. It is worth mentioning, however, that nearly 50 per cent. of July figures is represented by one company, namely, the Distilling Company of America, with $125,000,000 capital. Considering this fact, it is very apparent that the rush toward industrial consolidations has experienced a decided halt. In May the companies capitalized with $1,000,000 or more reached $500,000,000, which was surpassed in both April and March.

APPARATUS WANTED FOR TRENTON FALLS.—W. A. Breckenridge, engineer of the Niagara Falls Power Company, has completed for the Utica, N. Y., Electric Light and Power Company the plans and specifications for the erection of a plant to develop electrical power at Trenton Falls and transmit the current to Utica. Copies of the plans and specifications have been mailed to various contractors and their proposals for doing the work required are to be presented on or before Aug. 24, when they will be considered by the company and those deemed most favorable accepted. Maps and drawings are on file at the company's office, and may be inspected there by contractors or others interested. Briefly stated the plans provide for the erection of a dam 50 feet high and 200 feet long; for a cut 2500 feet in length along the west side of the gorge; excavations for a site for the power house itself and the construction of a tail race. The bidders are required to undertake the work that may be awarded to them at the earliest possible moment, and in their proposals they are required to name the date by which they will agree to have the same completed. The company desires to have the project prosecuted without delay, and the question of time will figure in the awards.

THE MICA TRUST.—As noted in these columns last week, there has been talk for some time past of the formation of a mica trust, a corporation which would control the entire world's output of mica. A dispatch from Chicago announced that seven large mica companies had formed such a trust with a capitalization of $3,500,000. The title of the new organization, it was said, was to be the American Mica Company, and it was to include—according to the Chicago report—the following individuals and companies: A. O. Schoonmaker, of New York; W. A. Sills Mica Company, of Chicago; the North Carolina Mica Company; Joseph Huse & Son; the American Mica Company, of Boston; Eugene Munsell & Co., and the Palermo Mica Company, of New York. It was ascertained last week that the two last-named concerns and A. O. Schoonmaker, of this city, are not in any combination. George S. Leary, secretary and treasurer of the Palermo Mica Company, said that neither his company nor the firm of Eugene Munsell & Co. had joined a trust, and he knew nothing about an alleged increase in prices after Sept. 1.

THE PRICE OF ZINC is by no means the interesting matter to electricians it once was, but they still use a great deal of the metal in various lines of work, and keep an eye on its quotations. Hence it is worthy of record that the climax of the Missouri-Kansas Zinc Miners' Association's fight against the smelters for higher prices for zinc was reached last week, when the association announced that it had made the prices for all grades of zinc ore for the next six months. This means prices for about $8,000,000 worth of zinc ore. Heretofore the schedule of prices has been made weekly. Six months ago, when the Zinc Miners' Association was fully organized, the smelters made the prices and bought up the zinc ore at such prices as they saw fit to pay. Since the association organized, prices of ore have almost doubled. The schedule for the ensuing half-year makes the price for ore running 63 per cent. metal $46 per ton, and for every 1 per cent. metal less $1 less per ton. The zinc ore of the district named generally runs from 50 to 63 per cent. metal. It is predicted that high-grade zinc ore will go to $50 within a month.

NAVY YARD BIDS.—Last week we quoted the bids made for the power plant at the Brooklyn Navy Yard. Some of the bids will be thrown out, and the work readvertised, and it is reported possible that this may be the case with the electrical and steam part, of which we gave the figures. One point is that whereas the requirements were for an alternating power plant, the conditions and opinions favor distinctly one for direct current distribution. The specifications provided that the government furnish the building, 80x100 feet, and a stack 150 feet high. The boilers supplied by the contractor are to be three aggregating 1200-hp. Three engines provided, each directly connected to a 400-kw alternating generator, are to be of the vertical cross compound and condensing type, operating at 133 revolutions per minute. The motors must supply about 1800-hp, all of the alternating current type, operating from a two-phase current at 200 to 220 volts and 3000 alternations per minute.

REPAIR SHOPS.—In the aggregate the amount of material now worked up by the electrical repair shops owned by local supply companies is now enormous. The street railway companies from the nature of their business have to carry on machine shops of the largest kinds, and go in not only for repairs, but a large amount of original construction. But the electric lighting companies also employ a great many tools in their repair departments, and consume quantities of wire, insulating tape and fibre, metal specialties, solder, etc. The telegraph companies have long had their supply departments, and do much of their own work, and the growth of the telephone business now opens up another large class of "good pay" customers. One of the most progressive systems is that of the Erie Bell, which has gained 24,000 subscribers since January, under President Glidden's vigorous policy. It is now stated that the Erie system has under serious consideration the establishment of a repair and manufacturing department in Chicago.

NAVY CONTRACTS.—The Government appears to have plenty of new work cropping up, in which electrical people will be duly interested from time to time. In addition to the Navy Yard, Brooklyn, contracts, bids on which were quoted in our last issue, two clothing factories are to be established by the Navy Department, where most of the clothing worn by the enlisted men, stewards and servants on board the vessels of the service will be manufactured, and where all materials used in making the sailors' wardrobes will be examined and tested before being accepted and sent to the ships. One of the new factories is to be in the Mare Island Navy Yard, California, while the other is to be erected and operated in conjunction with what is now termed the clothing factory at the Brooklyn Navy Yard. For the latter considerable electric light and power and some electric elevators will be required.

A LARGE POWER CONTRACT.—The St. Croix Power Company, of Wisconsin, incorporated not long ago, has contracted for a complete electrical and hydraulic plant, to be erected at once on Apple River, about 11 miles from New Richmond, Wis. The current will be transmitted at 25,000 volts to St. Paul, Minn., 28 miles away, where the St. Paul Gas & Electric Light Company have arranged to buy all the power developed. Floy & Carpenter, consulting engineers, 220 Broadway, New York, are the engineers for the St. Croix Company, and contracts based on their plans and specifications have been let to the General Electric Company, and the Stillwell-Bierce-Smith-Vaile Company for the turbines, etc. Work will be begun at once, and it is expected that current will be delivered in St. Paul by next January.

THE BEST EXPORT RECORD.—American manufacturers made their best export record in the fiscal year just ended. Not only were their exportations larger than in any preceding year, but for the second time in the history of our foreign commerce they exceeded the value of the imports of manufactures. In the fiscal year 1898, for the first time in the history of the manufacturing export trade, the exportation of manufactures exceeded the importation, the total value of exports of manufactures being about 25 per cent. in excess of that of imports of manufactures. In the fiscal year 1899, however, despite the increase in imports of manufactures, the total exportation of manufactures was 30 per cent. greater than the importation of manufactures, being $338,667,794, against $259,570,293 of imports of manufactures.

THE RIKER ELECTRIC MOTOR COMPANY has issued formal notice to the trade that the business hitherto conducted in Brooklyn by it has now been transferred to the Riker Electric Vehicle Company, incorporated under the laws of New Jersey, with factories and general offices at Elizabethport, N. J. The details of the new company formed by the co-operation of Messrs. Andrew L. Riker, Charles A. Lieb and their associates, are already familiar to the readers of this journal. The new work is being actively pushed at Elizabethport, and Mr. Riker, whose ability and solid work of the past 15 years are now so fully recognized, is extremely busy on new automobiles and new designs. He has recently received a number of large orders at home and abroad.

BRITISH WESTINGHOUSE COMPANY.—It is stated by a special cable dispatch from London of Aug. 12 that "at an extraordinary meeting of the British Westinghouse Company, held recently, it was decided to take over the Westinghouse Works in Manchester, hitherto a separate concern. The capital of the company has been increased by £250,000. The new works, as recently announced, will be quickly constructed, an American company agreeing to supply all the ironwork within four months. Reference was made at the meeting to the backward position of Great Britain in regard to the electrical industry, and it was said this company, combining American and British capital, is designed to wipe out this reproach."

THE BABCOCK & WILCOX COMPANY has, as stated by us already, sold to the Manhattan Elevated Railway Company, of New York City, the boilers required for its new electric generating plant, which will furnish electric current for operating its entire elevated railway system in New York City. The boiler equipment will consist of 64 520-hp Babcock & Wilcox all wrought steel boilers, capable of carrying a working pressure of 200 pounds per square inch. The boilers will be fitted with Roney automatic stokers, manufactured by Westinghouse, Church, Kerr & Company. This is understood to be the largest single order ever placed for stationary boilers.

AMERICAN ENGINES ORDERED.—A special dispatch from Glasgow, Scotland, of Aug. 15, says: By a vote of 7 to 6, the Glasgow Tramway Committee to-day accepted the tender of the Edward P. Allis Company of the United States for the engines to supply electric power. The figures of the successful tender are £114,544. Harvey & Williamson, of the United States, were the next lowest bidders at £160,000.

MR. JOHN J. GRANT, president of the Grant Machine Tool Works, of Cleveland, Ohio, is in New York this week. The company is building a line of tools entirely novel in construction, which, Mr. Grant states, are meeting with such general approval that the company is to-day unable to accept orders for immediate delivery. It contemplates extending its plant.

MR. R. C. M'KINNEY has been elected president of the new Niles-Bement-Pond Company, which consolidates those well-known tool interests in a concern with a capital of $3,000,000 preferred at 6 per cent. cumulative and $5,000,000 in common stock.

Special Correspondence.

NEW YORK NOTES.

New York, Aug. 16, 1899.

NEW YORK CENTRAL TUNNEL.—The recent general adoption of electricity on steam railroads has started a new agitation for the abolition of steam and all its horrible discomforts in the tunnel that connects the New York Central system with Greater New York.

PRESIDENT ROSSITER, of the Brooklyn Rapid Transit Company, has denied the rumors that he intended to resign. The Directors are delighted, he said, with the management of the strike, which cost the company about $150,000. The earnings of the company in July were $885,875, and the corresponding month last year $935,474.33.

KINGSBRIDGE ROAD FRANCHISE.—Acting Mayor Guggenheimer has signed the resolution granting a railroad franchise on Kingsbridge road and other streets in that neighborhood. This is the franchise granted to the Third Avenue Company three or four years ago, which provoked so much opposition that the matter was taken to the Court of Appeals and the grant revoked. Since then the Third Avenue and the Metropolitan companies have come to an arrangement by which they divide the profits and operate the new branches in conjunction.

METROPOLITAN CONDUITS.—Before the Mazet Investigation Committee last week, Mr. H. S. Kearny, Commissioner of Public Buildings, Lighting and Supplies, testified as to the conduits of the Metropolitan Street Railway Company in New York City, and expressed the opinion that they were not

more than sufficient. The Third Avenue Railroad had permission to lay the same conduits with 72 ducts. He complained of the delay of the Municipal Assembly in approving the rules and regulations for gas and electric lighting, thereby preventing proper contracts from being made.

RAILROAD TELEGRAPHERS.—There is a controversy between the New York, New Haven & Hartford road and its train telegraphers and a possible strike impends. Meantime, the company is establishing telephone connections between all the offices from Boston to New York, and that telephone boxes are being placed in all of the signal towers. These telephones were being put in merely as auxiliary to their regular telegraph service. Concerning the report that the placing of the instruments is being hurried in order to head off a strike of telegraph operators, the superintendent said: "We certainly are not putting in telephone connections in anticipation of a strike among the telegraph operators. Telephones are coming into general use everywhere now, and we are adopting them to add to the facility of communication. That's all there is to it. We have the four-track system, and so the signal towers are not needed except at the big stations."

STREET RAILWAY VACATIONS.—President Vreeland, of the Metropolitan Street Railway, issued an order last week which marks a new era in the history of street railways. All conductors and motormen who remained loyal to the company during the strike on July 19 and 20 are to enjoy three days' vacation with full pay. The order includes not only the men actually at work on those days, but also the ones prevented by sickness or forcibly detained by strikers from reporting for duty. The wages of conductors and motormen vary according to length of service from $2 to $2.50 per day; and, as the order extends to all lines of the Metropolitan system, it was said at the company's offices that the number of men affected would be about 4000. Application blanks for leave have been distributed, and when these have been filled out the names of the men and the dates of their vacations will be tabulated. The employees were taken completely by surprise by Mr. Vreeland's order, and at the various barns united in praising the company's liberality.

TROLLEY OVER JAMAICA BAY.—The Co-operative Society of New Jersey has filed in the office of the Queens County Clerk, New York, a lease of a strip of land 150 feet wide, extending from Long Point, a projection from the meadows into Jamaica Bay, to Far Rockaway, across Jamaica Bay about four miles. Patrick H. Flynn is to construct a turnpike road seventy feet wide over this strip, with proper drawbridges. Over $1,000,000 will be expended. A double trolley track will extend down one side of the new road, and a driveway and bicycle track will occupy the remainder of the road. The privilege is also granted to lay gas and water mains and to erect electric light poles along the road. It is said that the building of this road is only the first step toward the redemption of these half-submerged lands. Ex-Supervisor Dunton, who holds a lease of several thousand acres capable of development, says that there are a number of capitalists interested in building a Venice by the sea in Jamaica Bay.

TESTS ON LONG ISLAND RAILROAD.—The Cox bare wire "third rail" system, invented by Mr. H. B. Cox, is being tried on a short section of the Long Island Railroad. The bare conductor is carried in a closed trough running along the ties parallel with and equidistant from the rails. On top of this copper cable is another smaller cable, about the size of a telegraph wire, lying loose. As a train passes along a powerful magnet on the bottom of the cars lifts this smaller wire, which thereupon becomes electrically charged for the length of the cars, but is dead two feet ahead of or behind the car. President William H. Baldwin, Jr., of the Long Island Railroad, in speaking of the tests, said last week: "These tests have been made on our road for the last few months in an experimental sort of way. I have been much interested in the development of this idea. It seems to have the necessary elements for a successful third rail system. I have no personal interest whatsoever in the matter, beyond the desire to find some third rail system that will prove economical, effective and safe. If the owners of this system are ready to make a business proposition for its use, we would consider favorably the application of that system for experimental use, with a view to its adoption. We would experiment with any third rail system that appealed to our judgment."

PHILADELPHIA NOTE.

Philadelphia, Pa., Aug. 15, 1899.

COMMERCIAL CONGRESS STEAMER RATES.—Arrangements are nearing completion with various steamship lines arriving in this country for the transportation at reduced rates of foreign delegates to the International Commercial Congress at the Philadelphia Export Exposition. To date no less than twenty lines plying between this country and ports in Europe and Central and South America and West Indies have agreed to give exceptionally low rates to delegates showing their credentials to the companies' agents when purchasing tickets.

PITTSBURG NOTES.

Pittsburg, Pa., Aug. 12, 1899.

MR. G. F. GREENWOOD, general manager of the Havana Electric Railway Company, who has been in this city during the last month, is about to return to Cuba and superintend the completion of the street car lines in Havana controlled by his company.

MR. CHARLES W. TORRENS, consulting electrical engineer of the Winfield-Bowles Electric Company, of London, England, has come to this city for a stay of several weeks, to study the latest developments of electricity at the Westinghouse factory in the interest of his company.

THE BIRMINGHAM TRACTION COMPANY.—At the anual meeting of the Birmingham Traction Company, it was stated the company made a profit of $82,996 during last year's operation. The directors elected were: Harry Moore, president; A. C. Wettengel, vice-president; James S. McKelvey, John C. Fisher, William R. Ford, David Yost and Jacob Hauch. The new officers of the company are: Weaver H. Rogers, secretary-treasurer; A. B. Beltz, assistant secretary-treasurer; Thomas J. Layton, general superintendent; W. F. Long and J. H. Pierce, assistant superintendents.

INDIANA NOTES.

Indianapolis, Ind., Aug. 12, 1899.

A NEW RAILWAY PROJECTED.—An electric line from Crawfordsville to Hooperton, passing through Montgomery County at the Indiana Mineral Springs, is contemplated. Ample capital is behind the scheme and no opposition is manifest.

CONSOLIDATION.—The Cincinnati, Lawrenceburg & Aurora Electric Railroad Company, which has lines both in Ohio and Indiana, has filed articles of consolidation of the two lines. The capital stock is placed at $35,000. The Indiana branch of the line is now in course of construction.

TELEPHONE EXCHANGE BURNED.—Early on the morning of Aug. 5 an electric light wire came in contact with the line of the Mutual Telephone Company, at Shelbyville, and caused the complete destruction of the telephone exchange by fire. Four hundred instruments were thrown out of service and three hundred local connections destroyed.

TO BUILD ITS OWN CARS.—The managers of the Indianapolis Street Railway Company announce that the company will soon be prepared to build all its own cars. Ground has been broken for the erection of a large shop for that purpose and machinery ordered. Charles Remelius, formerly of Detroit, has been appointed master mechanic of the shops. The enterprise will require the labor of 100 men and the capacity of the plant will be one car per day.

NEW TELEPHONE COMPANY.—The commissioners of Boone County granted the Independent Long Distance Telephone Company right of way through the county, the line to connect Thorntown, Lebanon, Whitestown, Zionsville and other minor points in Boone County. The plant is almost completed the entire distance. The new company guarantees rates not exceeding 20 cents between towns, with other tolls at least 20 per cent. less than exacted by the Bell Company.

TELEPHONE COMPANIES COMBINE.—The Prairie Telephone Company, with headquarters at Brookston, and the Jasper County Telephone Company, headquarters at Rensselaer; the Western Indiana Telephone Company, headquarters at Goodland, and the Banson Company, headquarters at Oxford, have combined. These companies are under sub-license from the Central Union Telephone Company in territory, which includes five contiguous counties. Each company has an equal number of the telephones in operation, i. e., one hundred.

BOND ISSUE.—The Union Traction Company, which is building an interurban electric railroad between Indianapolis and Anderson, has issued $5,000,000 of bonds. The company's managers announce that it is their purpose to invest $3,440,000 in the construction of the road between the two cites and in the purchase of other connecting interurban lines. Randall Morgan, one of the principal owners of the Indianapolis Street Railway Company, is a member of the board of directors of the traction company. The work of grading is progressing at several points.

CHICAGO NOTES.

Chicago, Ill., Aug. 10, 1899.

MR. EMIL GRAH, engaged in the electrical engineering and supply business at Toledo, was in Chicago on a business trip last week.

ELECTRIC LIGHTING EXTENSION.—The work of extending the electrical lighting system of the city is being seriously handicapped, according to City Electrician Ellicott, by the inability of the electrical supply houses to fill the city's orders. There is apparently a boom in this kind of work, as all of the companies are busy, and on this account the city officials believe they will be delayed in their work this year from 30 to 60 days.

CHICAGO EDISON COMPANY.—The reports as to the sale of the Chicago Edison Company have been very circumstantially renewed during the past week, and the People's Gas Company is now named as party to the negotiations. It is pretty well understood that some large deal is going on, but those who are conducting it, President Insull himself being named as the manager of the whole affair, display their usual reticence. It is said that the deal will be one of the largest of its kind, but that many details still have to be arranged.

THE NEW TELEPHONE COMPANY.—Officials of the Illinois Telephone & Telegraph Company are highly elated over the success of their venture during the first 24 hours the public was given a chance to subscribe to an independent telephone service. The blank contracts and prospectuses sent through the mails to the subscribers of the company, it is stated, brought back 500 signed contracts from business men, and the number is being increased with every mail. The work of surveying the streets and preparing for conduits to contain the wires for the initial circuit is still under way, and men will be engaged day and night to push the work.

TO BOND RAILWAY EMPLOYEES.—The Chicago Union Traction Company is about to adopt the system of bonding its gripmen, motormen and conductors, according to the report which prevailed among its employees. While President Spalding will not admit that there is any foundation for the report, it is believed by the men and has become the prevailing topic of discussion around the barns and among the employees who will be affected. The payment of thousands of dollars annually in the settlement of damage cases, as soon as the gripmen, motormen and conductors furnish surety bonds, would be assumed by the surety company furnishing the bonds.

ST. LOUIS NOTES.

St. Louis, Mo., Aug. 10, 1899.

WORK ON THE BRENTWOOD & CLAYTON RAILROAD will be commenced at once. Condemnation proceedings against owners of several tracts of land through which the company wants to build will soon be instituted. The road will be first class in equipment.

WANTS RAILWAY FRANCHISE.—The Belleville & Interurban Electric Railroad Company has had introduced ordinances at the meetings of the City Councils and Village Boards of East St. Louis, Marcoutah, Smithton and Freeburg for franchises to construct and operate electric roads.

EAST SIDE LINES INCORPORATED.—Articles of incorporation of the St. Louis & Belleville Traction Company, which has absorbed the Day and Suburban electric lines, were filed at Belleville last week. The life of the corporation is to continue for fifty years, from July 14, 1899. The capital stock is $1,500,000. The incorporators are J. A. Day, Ed Ebend, Z. W. Tinker, George J. Kobusch and C. R. Bartlett.

MISSISSIPPI VALLEY ELECTRIC RAILROAD.—The incorporation of this road will probably take place this week. It will be capitalized at from $1,000,000 to $1,500,000. The promoters are Charles E. Carroll and George P. Heckel and other St. Louisians. The road will run from East St. Louis to Collinsville, Edwardsville, Alton and back to East St. Louis. The power house will be built either at Edwardsville or Collinsville.

RESIGNATION OF CAPT. M'CULLOCH.—Capt. Robert McCulloch, for many years connected with the lines of the National Railway Company as general manager, will not remain in the employ of the United Railways Company of St. Louis. He has tendered his resignation as division superintendent of that company, to which he was elected a few days ago, to take effect at the end of the present month. Capt. McCulloch's intentions for the future are not known.

CONSOLIDATION.—The Alton Railway & Illuminating Company, on Aug. 7, was merged into the Alton Railway, Gas & Electric Company, with a capital of $500,000, increased from $250,000. The leading stockholders of the Alton Railway & Illuminating Company were J. G. White, of New York, and J. F. Porter, of Alton, the latter being president. In the consolidation Mr. Porter was elected president, and J. Porter, H. S. Baker, C. A. Caldwell, O. S. Stowell and J. A. Ryne, all of Alton, directors. The consolidation places the new company in control of all the street railways in Alton, Upper Alton and North Alton, as well as the electric light and gas plants. Improvements and extensions of the street railway lines already started will be continued.

TEXAS AND MEXICO NOTES.

Austin, Tex., Aug. 10, 1899.

MR. F. E. MONTEVERDE, an electrician, who is well known in western Mexico, is connected with the Electric Lighting Company, of Hermosillo, state of Sonora, Mexico.

ENLARGING THE GUADALAJARA POWER PLANT.—The electric light company of Guadalajara, Mexico, is installing four new dynamos at the Falls of Juanacatlan, near the city, to supply the increased demand for electric power and light. The officials of this company are energetic and progressive. Many important improvements to the extensive plant have been made within the past two years.

FRANCHISE TAXATION IN TEXAS.—The State Tax Commission of Texas, which was created by the last legislature for the purpose of considering and recommending reforms in the taxation laws, have determined to urge the passage of a bill at the special session of the legislature, to be held next November, providing for the taxing of franchises of all kinds. Under the provisions of this proposed measure telephone, telegraph, electric light and power and street railway corporations will come in for a big share of the additional taxation burden that is to be imposed.

TO DEVELOP A MEXICAN WATER POWER.—A valuable water power concession has just been granted by the Mexican Government to Manuel Cuesta Gallardo, of the City of Mexico. He is granted the right to utilize the waters of the Santiago River, in the state of Jalisco. It is Mr. Gallardo's intention to install an electric plant. He is given permission under the terms of the concession to construct the works necessary for the full development of the power, and may take what land is required for that purpose. He has deposited $5000 in the national treasury as a guarantee that he will carry out the provisions of the concession.

PACIFIC COAST NOTES.

San Francisco, Cal., Aug. 9, 1899.

A PROPOSED ELECTRIC RAILWAY.—An electric railway from Santa Monica, Cal., to Redondo is said to be assured by the interesting of Eastern capital. Summer resorts at the ocean beach would be catered to, and at least $250,000 would be expended on the system.

ELECTRICAL DISPLAY FOR MANILA HEROES.—Plans are being prepared for an extensive electrical display, with decorative effects on the return of the California Volunteers from Manila to San Francisco, where a two days' celebration will take place.

MR. THOMAS E. THEBERATH, electrician, with the Stanley Electric Manufacturing Company's Pacific Coast agency, has left that position to become electrician to the Yuba Electric Power Company, of Marysville, Cal. The plant was installed under Mr. Theberath's supervision.

THE PROJECT of an electric railway between Grass Valley and Nevada City, Cal., is bein agitated again. Capt. John Vross, who was connected with the Terminal Railway system, and who built the first electric lines in Lexington, Ky., and in Little Rock, Ark., recently visited Nevada City in the interest of his plan for an electric railway.

THE TRUCKEE RIVER GENERAL ELECTRIC COMPANY, composed of California and Eastern capitalists, will, it is said, secure the contract to supply electric power for the Comstock mines in Nevada. The Cheap Power Committee of the Comstock Pumping Association recently found that the above company's offer was the most satisfactory that had been made. The generating station will be located near Floriston, Nev.

General News.

THE TELEGRAPH AND TELEPHONE.

MILWAUKEE, WIS.—The reports that the Chicago & Superior Telephone Company at Appleton is planning to sell its good will and franchises to the Wisconsin Telephone Company is authoritatively denied.

CUBA.—The Colon Consolidated Company, of New York, has been formed to operate electric light, telephone, and ice plants in Cuba; capital, $30,000. Directors—Hugh McCulloch, Jose Machado and Marino G. Peole, New York City.

HALLSBORO, VA.—The Chesterfield & Powhatan Telephone Company has been organized here. Capital, $5,000. Incorporators: W. W. Baker, B. T. Watkins, of Hallsboro; Dr. J. B. Fisher, W. P. Field, of Midlothian; A. L. Adamson, of Bon Air; R. A. Justis, L. P. Hill, of Dry Bridge; M. A. Cogbill, P. V. Cogbill, of Chesterfield.

WHITE RIVER JUNCTION, VT.—At the stockholders' meeting of the Vermont & Boston Telegraph Company, held recently, the following officers were chosen: Thomas T. Eckert, president; Charles A. Tinker, vice-president; A. R. Brewer, secretary; Myron T. Wilbur, treasurer; Charles A. Tinker and Thomas F. Clark, Executive Committee.

PACIFIC POSTAL.—At Albany, N. Y., on Aug. 12, a certificate of reduction of the capital stock of the Pacific Postal Telegraph and Cable Company of New York City from $1,000,000 to $100,000 was filed with the Secretary of State. The amount of the company's capital actually paid in is $1,000,000, and the liabilities are less than $5000. Among the directors are R. V. Dey, John W. Mackay, William H. Baker, Charles R. Hosmer and A. B. Chandler.

CLEVELAND, O.—The striking linemen and electricians of the Cuyahoga Telephone Company announce that over 1,000 telephone linemen engaged in construction work in various parts of the State for the United States Telephone Company are now out on strike, out of sympathy with the Big Consolidated Street Railway employees. It is stated that an effort will be made in Pennsylvania and Indiana to induce the men employed by the United States Company to strike.

KANSAS CITY, MO.—The Missouri & Kansas Telephone Company is preparing a new system of rates for house telephones to become effective soon. It will make a minimum rate of $18 a year for house telephones on circuit lines based on a minimum of thirty calls a month. The plan is to charge five cents for each call made, but it only counts one way. There is one limitation. The subscriber must agree to pay for thirty calls a month, or $1.50, whether he uses the telephone that number of times or not.

ATLANTA, GA.—A bill has been filed in the Superior Court at Atlanta, Ga., to place the Atlanta Standard Telephone Company, an independent telephone corporation capitalized at $800,000, in the hands of a receiver. It is charged that the company has defaulted in the interest on its bonds. The original bill was filed at the instance of Joseph Herzog of New York, who owned three bonds of $100 each. At his instance the Atlanta Trust & Banking Company, the trustee of the bond issue of $500,000, applied to the court to foreclose its mortgage on the property of the company.

RAILROAD TELEGRAPHERS RESTLESS.—Mr. John D. Cardinal, secretary of the Order of Railway Telegraphers, says: "Unless the New York, New Haven & Hartford Railroad accedes to the demand of the telegraphers, the operators will strike as a body all along the Consolidated road. This has been decided upon. The strike will extend also to the Boston & Maine road, and the Boston & Albany, and all the telegraphers on those lines, I am confident, will join the number. The Consolidated road conductors and brakemen will strike in sympathy with the telegraphers. At present there is every indication of a strike." Secretary Cardinal said that President Powell, of the National Telegraphers' Association would be on the ground soon when a final effort would be made to settle the difficulties between the telegraphers and the railroad without a strike.

LOUISVILLE, KY.—A recent special dispatch from Louisville says: New York capitalists are interested in a new telephone system, to be established in this city to compete with the Ohio Valley Telephone Company. Fully $2,000,000 will be invested, but the parties interested will not limit the outlay. The representative here of the New York people is J. A. Steinau, who has secured the transfer ot a franchise granted by the General Council to the Louisville Underground Electric Light, Telegraph & Telephone Company several years ago. Dissensions arose among the stockholders, and nothing was accomplished. Mr. Steinau has secured possession of the franchise after a year's hard work, but refuses to tell the price paid for it. It is understood that the Ohio Valley Telephone Company will fight the new company in the courts, but Mr. Steinau says the franchise will easily stand the legal test.

TELEPHONY ON LONG ISLAND.—A dispatch from Freeport, L. I., of recent date, says: "There is a telephone war on in this section of Long Island, tween the New York & New Jersey Company and the South Shore Company. Eighteen months ago the South Shore Company was organized by local capitalists, and a large number of telephones were placed in stores and residences in Freeport, Baldwin, Rockville Centre, Lynbrook, East Rockaway, Hempstead and Merrick. The company did so well that at its first annual meeting a 3 per cent. dividend was declared. The New York & New Jersey Company

asked permission to extend its lines, but consent was withheld for a long time, as the village trustees favored the local company. Arrangements were, however, made for the company to attach its wires to the village electric light poles, and as soon as it got a foothold it began the campaign by reducing rates in order to secure subscribers. In some cases telephones were offered free to those who would put them in on the stipulation that only pay station rates for messages would be charged. The local company has not been idle, however, and its service has been extended to Wreck Lead and Long Beach..

ELECTRIC LIGHT AND POWER.

ALTON, ILL.—The Alton Railway, Gas & Electric Company has been organized, with a capital of $250,000, by H. S. Baker, O. S. Stowell, J. F. Porter.

SPENCER, MASS.—The Citizens' Gas & Electric Light Company has been incorporated by E. Jones, F. A. Drury, N. Sagendorpt. The capital stock is $60,000.

CHELSEA, VT.—The Chelsea Electric Light & Power Company has been incorporated by W. F. Davis, E. D. Burnes, Viola Davis, with a capital stock of $10,000.

WHEELING, W. VA.—The National Light, Heat & Power Company, with a capital of $500,000, has been incorporated by J. Piedell, J. A. Miller, C. H. Copp, Wheeling.

WEST BETHLEHEM, PA.—The West Bethlehem Light Company has been incorporated by E. W. Mulligan, Liddon Flick, John Flanigan, of Wilkesbarre. The capital of the company is $1000.

CRIPPLE CREEK, COL.—The Gold Belt Electric Company has been organized, with a capital of $300,000, to build a plant to furnish power, etc., to the mines. The incorporators are Syl. T. Smith, J. B. Hogarth, Thomas Keeley.

CAMDEN, N. J.—The Wildwood, Holly Beach & Anglesea Electric Light, Heat & Power Company has been incorporated, with a capital of $30,000. The incorporated by E. W. Mulligan, Liddon Flick, John Flanigan, of Wilkesbarre. tal stock is $1000.

WASHINGTON, D. C.—On the night of Aug. 10 fire destroyed one of the buildings of the electric light plants of the Washington Traction & Electric Company, causing a loss of probably $50,000. The building was used for the storage of electrical appliances, and for stable and office purposes.

ALBANY, N. Y.—The Empire State Power Company, with principal office at Amsterdam, has been incorporated, with a capital stock of $1,000,000. Its objects are developing and selling electricity for light, heat and power in Albany, Schenectady, Montgomery, Schoharie and Fulton counties, and other counties in the state; also construct and maintain dams, etc., in the Schoharie Creek and its tributaries. The number of shares into which the stock is divided is $10,000, and the directors are William T. Mayer, of Albany; J. George Kaelber, of Rochester; Samuel Bolton, Jr., Ralph S. Everest, of Lansingburg; D. A. Devendorf, of Fort Hunter; W. Barlow Dunlap, of Amsterdam, and Clarence E. Sprout, of Williamsport, Pa.

THE ELECTRIC RAILWAY.

WHITINSVILLE, MASS.—A franchise has been granted to the Linwood Street Railway Company to operate an electric railway here.

HARRISBURG, PA.—The Progress & Linglestown Electric Railway, which will be organized in the course of a few days, will probably be leased by the Harrisburg Traction Company.

DETROIT, MICH.—Judge Lillibridge, of the Circuit Court, has delivered a decision permanently enjoining the street railway companies from carrying freight over their lines within the city.

BIRMINGHAM, ALA.—The Birmingham Railway & Electric Company is contemplating some extensions of its lines. This company controls and operates six electric railways and one steam dummy line.

MERRILL, WIS.—A street car ran off the Prairie Street bridge, at Merrill, Wis., on Aug. 11, dropping into the river twenty feet below. The car was completely wrecked. Several people were injured.

SPRINGFIELD, MO.—Col. L. H. Murray, who owns the Robertson Avenue & Walnut Street car lines, has purchased the Kickapoo line. The three lines will be consolidated and equipped electrically at once.

WASHINGTON, D. C.—Mr. V. B. Deyber has been elected treasurer of the Washington Traction & Electric Company, as H. D. Mirrick, who was chosen, declined to serve. J. B. Lackey has been elected assistant treasurer.

ROANOKE, VA.—Major R. M. Venable, representing a reorganization committee of the bondholders of the Roanoke electric railway, has bought the road at public auction for $150,000, and also an electric light and power plant owned by the company for $31,000.

TRENTON, N. J.—The Mercer County Traction Company has been incorporated with a capital of $100,000. Incorporators: Henry C. Moore, Ferd W. Roebling, of Trenton, N. J.; John A. Rigg, Reading, Pa.; Edward J. Moore, Philadelphia, Pa.; Thomas C. Barr, Newark, N. J.

TAUNTON, MASS.—A meeting will be held in a few days to form an electric street railway company, to run a line connecting with the Taunton Street Railway by the Winnecunnet Pond section to Easton, a distance of seven and a half miles, and connecting there with the Brockton line for Boston.

STEUBENVILLE, OHIO.—Steubenville Council granted a franchise to construct and operate a street railway between here and Mingo for 25 years to H. S. and L. E. Sands, William Lipphart, F. H. Eicke, W. H. Hearne and L. G. Hallock, all of Wheeling. These parties have purchased the Jefferson farm of 144 acres along the hill route for park purposes.

COXSACKIE, N. Y.—Before the New York State Board of Railroad Commissioners on Aug. 5, N. A. Culkins, on behalf of the Coxsackie & Greenwell Traction Company, asked the Board to allow the company to increase its capital stock from $200,000 to $350,000 in order to meet the cost for the construction of the road.

COMPETITION IN MAINE.—A special despatch says that the Maine Central and the Lewiston, Brunswick & Bath electric road are having a passenger rate war. The Maine Central has reduced its fares to meet the electric competition and the advocates of lower tariffs say the result will be electric roads paralleling the steam roads from Portland to Waterville.

NEW YORK, N. Y.—The last of the horse cars on the 28th and 29th street lines of the Metropolitan Street Railway Company, New York, have been taken off, and the road is now entirely operated by the compressed air system of the American Air Power Company. It is understood that the next road of the Metropolitan system to be equipped with air power cars will be the 34th street crosstown line.

SANDUSKY, OHIO.—S. R. Bullock, who represents various lighting plants at Fremont and Fostoria, has completed a deal whereby he gets the White Line and the Sandusky, Milan & Norwalk roads. The price paid is $150,000. The roads will be combined and operated as the Sandusky, Milan & Norwalk Traction Company, for which a franchise has been asked of the Secretary of State.

WILMINGTON, DEL.—General Manager Robert F. Fox, of the Wilmington City Railway Company, the Wilmington & Chester Railway Company and the Chester Traction Company, resigned on Aug. 1. Joseph C. Lugar, formerly superintendent of the Roxborough, Chestnut Hill & Norristown Railway, will succeed Mr. Fox. Harvey B. Vandegrift is to continue as superintendent of the city railway system.

WILKESBARRE, PA.—The syndicate which recently purchased the Traction Company's lines has appointed the following officers: General superintendent, Thomas A. Wright, of this city; superintendent of transportation, Thomas Clifford; assistant superintendent, Elwood Irwin; electrical engineer and superintendent of motive power, James Fagan; cashier, Pierce Butler; manager of the claim department, R. W. Day; chief clerk, Theodore S. Barber.

NEW HAVEN, CONN.—At the annual stockholders' meeting of the Winchester Avenue Street Railway Company an entire reorganization of the official directorate of the road was effected. The New England Street Railway Company held the balance of power, and elected six of the nine directors. The new officers of the road are: President, A. B. Turner, Boston; superintendent and treasurer, A. E. Pond, New Haven. The offices of vice-president and general manager were not filled.

ALBANY, N. Y.—Articles of incorporation of the Staten Island Rapid Transit Railway Company, a reorganization, have been filed with the Secretary of State. The company's capitalization is $500,000, and the directors are J. Frank Emmons, J. Van Smith, James M. Davis, O. S. Wood, Louis Stanton, Allan M. Jenk, Walter T. Lewis, James G. Lynch, Charles B. Hill, James H. Jones, Charles Kattenstroth, Edgar Geiershoffer and Norman Hall, of New York City. The company controls 24 miles of track.

PONTIAC, MICH.—On Aug. 5 the tracks of the Sylvan Lake Street Railway Company, in Saginaw Street, the main thoroughfare of the city, were torn up by a gang of men from Detroit. The latter are understood to have been employed by Aldermen and citizens. The streets were crowded soon after 1 a. m. by people called out by the continued blowing of steam whistles. The cause for this action against the company is the fact that the railway company opposed the paving of the street, and has enjoined the city from proceeding to do so. The Sylvan Lake Company's franchise requires it to pave the streets between its tracks. It has, it is understood, refused to do this unless other new concessions are made.

TROLLEY WRECK AVERTED.—At Winsted, Conn., on the afternoon of Aug. 11, what threatened to be another trolley disaster, similar to the catastrophe at Stratford, was narrowly averted. A car of the Torrington & Winchester Street Railway Company, in which were several passengers, mounted the rails as it was rounding the curve at the western approach to the bridge that crosses Mad River, and ran onto the bridgework and along the plank flooring some little distance. It would have toppled over into the river, about fifteen feet below, were it not for an iron railing about eight feet high which extended along the side of the bridge. The passengers escaped uninjured. The iron siding was badly damaged.

DETROIT, MICH.—A meeting of citizens who favor municipal ownership of street railways under some plan other than that urged by Gov. Pingree, was held on Aug. 4. It was decided to attempt to get authority for city ownership of street car lines through amendment of the city charter. Such proceedings have been made permissible through an act of the last Legislature, provided a majority of the people vote for it. A petition will be circulated, directed to the Common Council, asking for submission of the desired charter amendments to vote of the people. The plan of the promoters of this latest project is not to buy street railways, but to parallel or "straddle" present tracks. In other words to steal or confiscate property.

DRY DOCK ROAD, NEW YORK.—The Third Avenue Cable Railroad is pushing the work of reconstructing the roadbeds on the main line and branches as fast as possible, and before Oct. 1 it is expected that the cars on Third Avenue will be operated by the underground trolley system. The 125th Street road is also nearly completed. The new tracks on the Boulevard branch are laid most of the way, except between Forty-fifth and Forty-second Streets. The work of reconstruction on Forty-second Street began last week, and it will be several months before trolley cars are seen on that thoroughfare. It was reported that the Dry Dock, East Broadway & Battery lines would be equipped with the storage battery system, but this is erroneous. The fact that four storage batteries were bought for use in switching cars gave currency to the report. "We tried compressed air," says Supt. Robinson, "and, while it worked well, we liked the underground trolley system better, although it is more expensive. We shall not use the storage battery system on any of our lines. It is not as cheap as any of the other systems nor as reliable."

THE AUTOMOBILE.

THE NATIONAL AUTOMOBILE COMPANY will, it is stated, be incorporated in New Jersey next month, with $25,000,000 capital.

TO MANUFACTURE AUTOMOBILES.—It is stated that Pontiac (Mich.) carriage factories are now figuring on manufacturing automobiles.

MANUFACTURING IN PENNSYLVANIA.—It is announced that an automobile manufactory will be started at Carlisle, Pa. Capitalists are organizing a company, with a capital of $100,000, for this purpose. It is stated that about half the amount has already been subscribed.

THE H. T. HEARSEY VEHICLE COMPANY, recently organized at Indianapolis, Ind., has filed articles of incorporation with the Secretary of State; capital stock, $20,000. It proposes to handle automobiles, bicycles and other kinds of vehicles. The main object, however, is to sell "automobiles" and "runabouts."

THE KOKOMO AUTOMOBILE.—The manufacturers of the Kokomo automobile, and the citizens generally, are greatly elated over the successful long distance trip made by the Haynes-Apperson automobile between Kokomo, Ind., and Brooklyn, N. Y. The Indiana automobile is given credit for having made the first successful long distance trip in this country.

THE AUTOMOBILE CAR COMPANY has been formed in Pittsburg and an application will be made for a Pennsylvania charter. The capital stock, it is said, will be $1,000,000. It is the intention of the company to absorb the Pittsburg Motor Vehicle Company and manufacture automobiles on a large scale. The company expects to be ready to manufacture ten complete automobiles daily after Jan. 1.

THE PENNSYLVANIA ELECTRIC VEHICLE COMPANY intends to take full advantage of the Philadelphia Exposition to display its vehicles on the streets of that city. It has announced its intention of selling automobiles outright to the public, as well as to operate in Pennsylvania cities and towns. Its policy is not to tie up much money in experimental inventions, which are constantly being improved upon.

SPERRY CARRIAGE TESTED.—A run was made by the Sperry electric carriage or buggy on Aug. 5, in Cleveland, showing remarkable battery capacity. With 66 pounds of battery it covered no less than 114½ miles without a stop on the asphalt pavement of East Prospect street in that city. It is claimed that the carriage could have gone considerably further, but the passengers were tired out, although the batteries were not.

DETROIT AUTOMOBILE COMPANY.—Articles of incorporation of the Detroit Automobile Company have been filed. The capital stock is $150,000, of which $15,000 is paid in. The shareholders are: Col. Frank J. Hecker, Patrick A. Ducey, Clarence A. Black, Alfred E. F. White, Frank W. Eddy, William H. Murphy, Wm. C. McMillan, Fred S. Osborne and Clarence A. Black, trustee; Mayor Wm. C. Maybury, trustee; Safford S. DeLano and Frank R. Alderman.

AUTOMOBILE CLUB FOR BROOKLYN.—A movement is on foot in Brooklyn to organize an automobile club in that borough. The men who are the most actively interested are J. B. Hoecker, Dr. J. L. Zabriskie and Dr. William M. Hutchinson. The club, it is said, will be solely for the improvement of machines and their use, and will have no social features. Dr. Hutchinson was the first citizen of Brooklyn, outside the manufacturers, to have his own automobile. It was a Riker buggy.

THE LANCHESTER MOTOR.—In accordance with announcements previously made, a plant for the manufacture of the Lanchester oil motor, to cost $400,000, and to employ about 600 skilled mechanics, is to be built in Pittsburg. The company proposes to manufacture Lanchester oil motors, especially for the use of large freight trucks and street cars, though it has recently secured an option on all the oil motor patents in the United States and Canada and Mexico that are owned by the inventor, Frederick William Lanchester, of Birmingham, England, who is a large stockholder in the new concern.

THE AUTOMOBILE ORDINANCE which passed the Chicago City Council on July 6 became operative on Aug. 1. It provides that the operators, or drivers, of automobile vehicles shall be licensed, and that a board of examiners shall be appointed to examine into the qualifications, ability, etc., of applicants for such positions. The fee for the license to operate an automobile will be $3 for the first year and $1 for yearly renewals of the license. Automobiles must not be run in the city streets at a greater speed than eight miles per hour. The board above mentioned is officially designated the "Board of Examiners of Operators of Automobiles."

CALIFORNIA.—The California Autotruck Company, recently organized under the laws of the state of New Jersey, with a capital stock of $5,000,000, will soon operate horseless carriages on the streets of San Francisco and Oakland, Cal. The entire stock has been subscribed for, and the company is backed by the International Power Company. Business men in New York and San Francisco will own one-half of the stock and the other half is retained by the International Power Company. A carriage company will be formed in San Francisco on the plan of the General Carriage Company, of New York. This company will meet the demands of the local ply-for-hire service.

SPRINGFIELD, MASS.—It is stated that negotiations are being conducted with the object of securing the location in this city of the American Automobile Company's plant. It is proposed to utilize the plant of the Warwick Company, which has been idle since the collapse of that concern. The location of the company in this city would probably mean employment for nearly 200 hands at the start, and more as the automobile industry progresses. The Warwick plant is admirably adapted for such an industry, possessing ample floor space and freight facilities. Much of the machinery at present in the shops could be used to advantage in the manufacture of automobiles.

THE NATIONAL AUTOMOBILE COMPANY.—It is announced that the plans of the National Automobile Company are completed, and that the headquarters and the main factory will be situated in Chicago. The company is organized with a capital stock of $25,000,000 for the purpose of supplying trucks and all heavy vehicles in the principal cities of the United States. The president is a New York capitalist and the general manager probably will be a Chicago man. The company will be incorporated in New Jersey next month and probably will begin operations by the middle of September. It is proposed to enter into a wide field, which will be in direct competition with all other companies. Heavy trucks, express wagons and delivery wagons are to be put out as soon as the factories can make them.

THE AUTOCAR COMPANY.—The owners of the Pittsburg Motor Vehicle Company have formed the Autocar Company, and have applied for a charter at Harrisburg. The capital will probably be $1,000,000, and the new company will absorb the old one. It is the intention to build a large plant at once, and turn out ten complete vehicles per day. The directors of the new company follow: Charles J. Clark, the banker; Louis S. Clarke, president of the Pittsburg Motor Vehicle Company, and of the firm of Somers, Fitler & Clarke, Ltd.; J. Denniston Lyon, of W. R. Thompson & Co., bankers; William Morgan, secretary of Pittsburg Motor Vehicle Company, and F. K. Fitler, of Somers, Fitler & Clarke. Mr. Morgan has been elected secretary and treasurer. The plant will employ, when completed about Jan. 1, 500 men. Gasoline will be used as a motive power. A factory site has been purchased at Swissvale.

HOW TO DRESS FOR THE AUTOMOBILE.—The subject of appropriate dress for automobilists has received the attention of a New York connoisseur in the art of dressing. He says the sight of a man driving an automobile and wearing simultaneously a horseshoe pin in his scarf is as painful to the thorough dresser as tan shoes with a silk hat. Yet this combination has been frequently seen, and only the other day the American most conspicuously associated with the new sport had his photograph taken with a small riding whip in gold stuck into his coachman's white necktie. Automobile clothes are not of a kind likely to become popular among persons without strong ideas as to the necessity of being always in just the proper costume. Leather coats for women, and dark blue Oxford blouses, trimmed with leather, and leather yachting caps for both sexes are not details of dress that would ever appeal strongly to the public in general; but they have been declared officially to be the proper garments for the automobile, and the businesslike driver is supposed to dress himself in this way if he would be typical of the sport in all its particulars. The ugliness of the dress is said to have prevented its popularity here.

LEGAL.

STORAGE BATTERY INJUNCTION.—The Quincy & Boston Street Railway Company, which has been operating its Braintree line by storage battery, discontinued the use of the battery Aug. 1, in compliance with a temporary injunction granted the Electric Storage Battery Company, of Philadelphia, by Judge Colt. This was to restrain the users of the Hatch battery from continuing its use until the final hearing before the Appellate Court, which is set down for next October. The discontinuance of the use of the battery did not prevent the operation of the cars on this line, which is now supplied with current from the power stations of the company at Quincy Point. The details of the litigation were given in our columns recently.

PERSONAL.

MR. SAMUEL INSULL, president of the Chicago Edison Company, denies flatly the report that he is to prepare and read a paper for the meeting of the League of American Municipalities at Syracuse, N. Y., in September.

MR. ELMER A. SPERRY, of the Cleveland Machine Screw Company, was in New York last week and spoke most hopefully of work in the automobile field. His electric carriages, recently illustrated in these pages, are already well known and liked in France.

SIR ASHMEAD BARTLETT, the American who married Baroness Burdett Coutts, and is a member of the House of Commons, has received a concession from the Sultan of Turkey for a trolley road from Smyrna to Salonica, and it is said that some Americans are interested with him in the concession.

MR. J. C. HENRY, of Denver, Colo., the veteran inventor in the electric railway field, has been in the east in regard to some recent important new work of his, and settling up some real estate interests at Westfield, N. J. His son, only 19, has become a teller of stories in the western press, suggestive of a very bright future.

MR. AD. AHLSELL, manager, and Mr. Aug. Decker, chief engineer of the Stockholm, Sweden, Electricity Works, are on a short visit to the United States for the purpose of looking up the subject of high-voltage transmission. It has been proposed to supply an urgent need in Stockholm for more electric power by transmitting current from a waterfall 120 miles distant from the city.

MR. E. O. SESSIONS, recently manager of the electrical interests of Frank Jones, Portsmouth, N. H., and now with the General Electric Company, was married July 29 at Toledo, Ohio, to Miss Helen Madeline Potter. Mr. Sessions, whose entry into the electrical field dates back to the beginning of its engineering period, will have the best wishes of a multitude of friends in his new departure.

MR. ALBERT L. JOHNSON, formerly head of the Nassau Street Railway, Brooklyn, has laid plans to promote some trolley schemes in England. About Oct. 1 he will apply for a franchise for a trolley road from London to Brighton. The distance is forty-five miles, all over a private right of way, and the fare will be sixpence. Mr. Johnson says the grade will not exceed one and one-half feet to the mile, and the rails will be so heavy that he hopes the cars will average a mile a minute, except in the London limits. American capital, he says, is backing the scheme, and his brother, Mr. Tom Johnson, is also said to be interested.

MR. H. H. VREELAND'S CLAMBAKE.—The heads of the executive, financial, accounting, legal, engineering and operating departments of the New York Metropolitan Street Railway system were given an outing and a Rhode Island clambake on Aug. 12 by Herbert H. Vreeland, president of the company, at the grounds of the Tonetta Outing Club, near Brewster, N. Y. Mr. Vreeland greeted his guests as they alighted from the special cars attached to a train

which reached there a little before 11 o'clock. They entered carriages, and were driven to the grounds of the Tonetta Outing Club on the banks of a pretty lake. The guests were entertained at the clubrooms for a time, after which they were invited to the grounds to partake of the clambake. Then a sail on the lake was taken. The party then drove to "Rest Awhile," the country home of Mr. Vreeland, three miles away. They were received by Mrs. Vreeland, assisted by the Misses Crosby, of Brewster. Luncheon was served and the guests were shown about the house and grounds. The return was made on the train, which left Brewster about 7 o'clock, and arrived at the Grand Central Station about an hour later.

Trade and Industrial Notes.

THE NATIONAL LIGHT STORAGE BATTERY COMPANY, of Boston, Mass., has been incorporated in West Virginia, with a capital of $1,000,000.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY, Cincinnati, Ohio, has issued a bulletin on its engine type generators. It is well illustrated.

THE ELECTRIC STORAGE BATTERY COMPANY.—The New York office of this company has been moved to the American Surety Building, 100 Broadway, fifteenth floor.

THE CENTRAL ELECTRIC COMPANY, CHICAGO, is preparing an attractive booklet upon the Knapp annunciator. This firm is pleased with its success in placing many annunciators of this make.

THE COLUMBIA ELECTRIC & MANUFACTURING COMPANY, of Chicago, has been organized to manufacture electrical machinery, etc. Capital, $10,000. Incorporators: M. H. Neurath, G. M. Mayer, F. A. Baseuer.

THE COLUMBIA ELECTRICAL SUPPLY COMPANY, 93 Liberty street, New York, N. Y., Mr. J. C. Lott, representative, is sales agent for the Fort Wayne Electric Works of Fort Wayne, Ind., in the city of New York and vicinity.

THE STERLING ELECTRIC COMPANY, of Chicago, has furnished the Van Wert Home Telephone Company, Van Wert, Ohio, with a complete up-to-date exchange equipment, with a capacity of 500 subscribers, to replace outgrown apparatus.

THE NEW MOTOR COMPANY has been organized in Buffalo to manufacture and sell steam, air, gas, gasoline, and other motors, trolley bases, trolley heads, and trolley wheels, capital, $25,000. Directors, Samuel Wilkinson, E. L. Pixley and William M. Hoffman, Buffalo.

THE BILLINGS & SPENCER COMPANY, Hartford, Conn., has just issued an advance sheet of a new line of trolley line material, including hangers, clips, etc. The hangers are provided with a ratchet and pawl arrangement to insure against the liability of the caps becoming loose.

THE JONES & LAMPSON MACHINE COMPANY, of Springfield, Vt., is making extensive improvements to its plant, and has let the contract to the Berlin Iron Bridge Company, of East Berlin, Conn., for a new steel building 60 feet wide and 95 feet long. The building will have many special features.

SOUNDPROOF TELEPHONE BOOTHS.—Business men are rapidly recognizing the advantages of having their telephones placed so that they can converse without being overheard. The Mason Telephone Pay Station Company, of Ludington, Mich., reports very large sales of its new style portable soundproof telephone booths.

THE CHASE-SHAWMUT COMPANY, Boston, Mass., is distributing trade literature on the subject of "knockouts," enclosed fuse tablet boards, Cartwright enclosed air-tight fuses and Shawmut fuse wire. The "Treatise on Knockouts" gives some valuable information concerning the Chase "knockout" outlet and junction box.

THE HOBBS TELEPHONIC DISTRICT MESSENGER ELECTRIC MANUFACTURING COMPANY has been organized in New York, with a capital of $500,000. Incorporators, G. E. Brown, of Newburgh; J. D. Hobbs, of Jersey City, N. J.; W. R. Brown, A. M. Loury, of New York City; C. R. Callahan, of Hackensack, N. J.

SALEM IRON WORKS, of Salem, N. C., manufacturers of cross-arm braces and lag screws for construction work, have been successful in convincing purchasers that they are in a position to promptly fill orders with satisfactory goods, with the result that this department of their business has grown to a great extent and forms an important department of their regular work.

THE FULLER COMPANY, of Detroit, Mich., has met with so much success in its ventilating fans, blowers and blower engines that it is compelled to work overtime five nights per week. This condition of affairs has prevailed for some time now, and from present appearances the company will be obliged to continue working overtime for the next two months or so, at least.

THE ADAMS-BAGNALL ELECTRIC COMPANY, Cleveland, Ohio, has appointed Mr. G. A. Thomson its Eastern representative, vice Mr. C. W. Phipps, resigned. Mr. Thomson's headquarters are at 222 Havemeyer Building, New York, where he will be pleased to meet his friends and customers. The Adams-Bagnall Company reports that its new copper-case lamps, which embody new and original features, are meeting with much success.

WORTHINGTON CONDENSING APPARATUS.—Henry R. Worthington, New York, has issued a pamphlet illustrating "some recent installations of Worthington condensing apparatus." Thirty of the 32 pages contain illustrations of such installations, which cover a wide range of application of this apparatus. Electric light and power plants predominate. The navy and merchant marine are represented in the list. The pamphlet is gotten up in substantial form.

THE GENERAL ELECTRIC COMPANY has issued three bulletins on its commercial and United States Government types of searchlight projectors, C. R. regulators for series incandescent systems, and slow and moderate speed belt-driven generators. The bulletins are well illustrated, showing details and general views of the apparatus treated. Flyer No. 2044, recently issued, is on the subject of the "Wood" cutout for arc circuits. The company has also just published price list of its type H oil transformers.

HADAWAY ELECTRIC HEATING & ENGINE COMPANY, of 107 Liberty Street, New York, reports a very active inquiry for all of its electric heating apparatus. Mr. W. S. Hadaway, Jr., its general manager, etc., states that his company equipped and installed the interesting plant in the Carmelite hospice described in these pages a few weeks ago. There are many inquiries for work of that character, but the large output is for all kinds of industries where a steady, uniform heat is needed, handy to apply at difficult and exact points and times in various processes, or else difficult to maintain uniform. Electricity does it admirably.

"THE PATENT RECORD" is a handsome illustrated journal of 32 folio pages, published in Baltimore in the interest of inventors and persons engaged in the patent business. The Marconi system of wireless telegraphy is among the subjects presented in text and illustrations of a superior character. Mechanical contrivances are, of course, prominent. An illustrated article on "The Philippines and the Filipinos" indicates the varied character of the *Record's* topics. Paper and typography are good, and the contents of the paper should prove very interesting and generally instructive to a large number of people. Copies can be obtained on application.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, was among the first to see the unlimited possibilities which the independent telephone movement has opened up. By persistent efforts and hustling, it has kept pace with the times and gradually enlarged its telephone department until today it carries one of the largest stocks of telephone exchange and line material in the West. The company is just putting on the market its latest improved 1900 telephone, which has many new and novel features, among which is the transmitter, which is entirely moisture and damp-proof. The company claims that this transmitter will out-talk any on the market, and cannot pack. The transmitter proper can be removed and replaced in a moment.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED AUG. 8, 1899.

[In Charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

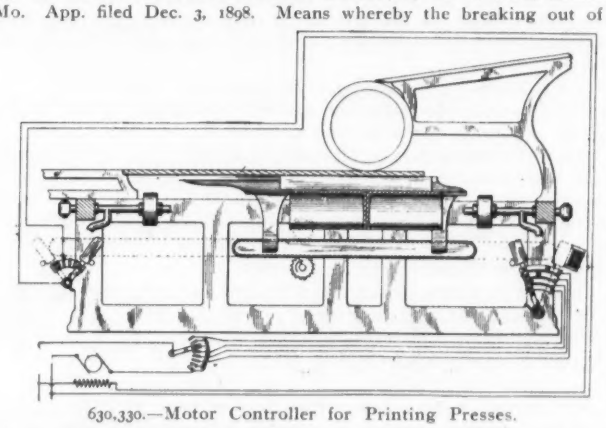
630,318. ARC RUPTURING DEVICE; E. J. Berg, Schenectady, N. Y. App. filed Dec. 17, 1898. (See Current News and Notes.)

630,330. MOTOR CONTROLLER FOR PRINTING PRESSES; A. H. Coupler, Chicago, Ill. App. filed Aug. 22, 1898. As the reciprocating table approaches the end of its travel it moves a switch which actuates the controller to increase the driving capacity of the motor, the object being to furnish the increased power necessary to move the table while it is reversing.

630,331. MOTOR CONTROLLER FOR PRINTING PRESSES; A. H. Coupler, Chicago, Ill. App. filed Aug. 22, 1898. A modification of the preceding in which the controller, located at one end of the machine, is arranged to be operated by the reciprocating table at each end of its stroke, there being mechanical connections transmitting the movement to the controller from levers at each end of the press.

530,333. DI-PHASE ELECTRIC MOTOR; S. M. Dietrich, Terre Haute, Ind. App. filed Nov. 8, 1898. The motor has a field magnet system composed of bipolar magnets isolated from each other, and each having both poles presented to the armature space one ahead of the other, considered circumferentially, and a single coil positioned relatively of the magnets and magnetizing all of them. The principal object is to prevent reversals of the flux in the armature.

630,345. AUTOMATIC FIRE ALARM SYSTEM; E. G. Hale, Kansas City, Mo. App. filed Dec. 3, 1898. Means whereby the breaking out of a fire will cause the transmission of a signal in tones of the human voice, a phonograph being used to specify the exact location of the fire both to parties in the vicinity and through the medium of a telephone, to points distant.



630,330.—Motor Controller for Printing Presses.

630,406. RADIOGRAPHIC APPARATUS; S. W. Puffer, Rochester, N. Y. App. filed Feb. 27, 1899. The object is to produce an apparatus whereby the accurate location of a foreign body in a permeable substance may be indicated, and the apparatus embodies a source of X-rays, a suitable receptive surface and two impermeable bars arranged one between the source of rays and the permeable subject, and the other between the permeable subject and the receptive surface; the bars carry adjustable indicators.

630,409. DYNAMO ELECTRIC MACHINE; H. G. Reis, Schenectady, N. Y. App. filed June 1, 1898. The pole pieces of the revolving field, the ring to which they are attached and the arms of the spider are made in separate pieces and secured together by bolts passing through the arms, the ring and into the polepieces.

630,418. METHOD OF AND MEANS FOR INDUCING MAGNETISM IN MAGNETIC CIRCUITS; C. Steinmetz, Yonkers, N. Y. App. filed Aug. 31, 1891. (See Current News and Notes.)

630,419. ALTERNATING CURRENT MOTOR; C. P. Steinmetz, Schenectady, N. Y. App. filed May 13, 1897. (See Current News and Notes.)

630,448. ELECTROMAGNETIC RECIPROCATING ENGINE; W. S. Couly, Los Angeles, Cal. App. filed Aug. 9, 1898. To avoid self-induction in the coils they are surrounded by split cylinders and separated into section by magnetic diaphragms.

630,460. AUTOMATIC RHEOSTAT; J. H. McGurty, Jersey City, N. J. App. filed Oct. 11, 1898. The invention refers to details of construction whereby the too rapid movement of the controller is prevented.

630,470. ELECTRIC ARC LAMP; S. Struttmann, Russelheim, Germany. App. filed July 14, 1898. Two pairs of carbons are used, the members of each pair being of like polarity and being arranged at an angle to each other, and the arc being formed between the converging point of one pair and that of the other. The carbons are peculiarly constructed to regulate the shape of the crater.

630,475. ELECTRIC HEADLIGHT LAMP; H. F. Wellman, Ashland, Ky. App. filed May 6, 1899. The circuit through the lamp is completed by the mere adjustment of the lamp to the vehicle, and the contacts are peculiarly constructed to avoid sparking when the lamp is removed in case one switch remains closed.

630,489. ALTERNATING CURRENT MOTOR; M. Déri, Vienna, Austria-Hungary. App. filed Jan. 12, 1898. (See Current News and Notes.)

630,490. DYNAMO ELECTRIC MACHINE AND METHOD OF OPERATING SAME; M. Déri, Vienna, Austria-Hungary. App. filed June 30, 1898. (See Current News and Notes.)

630,491. COMBINED ALTERNATING AND CONTINUOUS CURRENT SYSTEM OF DISTRIBUTION; M. Déri, Vienna, Austria-Hungary. App. filed July 27, 1898. (See Current News and Notes.)

630,492. ARRANGEMENT FOR EXCITING MAGNETS OF DYNAMO ELECTRIC MACHINES; M. Déri, Vienna, Austria-Hungary. App. filed Feb. 23, 1899. (See Current News and Notes.)

630,501. METALLIC CONDUIT FOR ELECTRIC WIRES; E. T. Greenfield, New York. App. filed Dec. 12, 1898. The conduit is vented radially in all directions throughout its length, so as to permit the free circulation of the atmosphere to its interior, and to provide an outlet for the gas generated by a short circuit.

630,502. MACHINE FOR MAKING ARMORED ELECTRIC CABLES; E. T. Greenfield, New York. App. filed Dec. 6, 1898. In this machine a main and an auxiliary motor are used to feed the cable and wind it up. In case the unarmored portion of the cable travels at a different speed from the armored, automatic devices act upon the motors to vary their speed accordingly.

630,503. METHOD OF AND MECHANISM FOR CONSTRUCTING ELECTRIC CONDUITS AND ARMORING FLEXIBLE TUBES AND ELECTRICAL CABLES; E. T. Greenfield, New York. App. filed March 29, 1899. A method of forming a tube of flexible material, consisting in forcing the material continuously forward against a bending surface which causes it to be formed into successive spirals with their lateral edges adjacent to each other and in alignment.

630,513. ELECTRIC ARC LAMP; J. E. Morris, Chester, Pa. App. filed Nov. 1, 1898. The invention consists of the construction of the dash-pot for trapping and freeing the air.

630,539. AUTOMATIC CIRCUIT BREAKER; E. M. Hewlett, Schenectady, N. Y. App. filed April 5, 1898. This circuit breaker has an overload of series coil, a shunt coil and a polarized relay controlling the circuit of the shunt coil, either the shunt or the series coil acting to open the circuit breaker.

630,568. DYNAMO; H. B. Schneider, Chicago, Ill. App. filed July 13, 1898. An armature resistance coil is carried on the armature itself and is cut into and out of circuit by a centrifugal governor.

630,598. ELECTROMECHANICAL PERFORATING MACHINE; G. H. Davis, New York. App. filed Dec. 12, 1894. This machine is adapted to be connected with a piano or organ by electrical means so as to produce a perforated music sheet simultaneously with the depression of the keys of the instrument. Such a sheet may be run through an automatic piano and reproduce the music.

630,599. PROTECTIVE CASING FOR ELECTRIC CABLES OR WIRES; H. P. Duglass and A. Sundh, New York. App. filed Jan. 6, 1897. The conductor is enclosed loosely in a rubber tube which is reinforced and protected by a fireproof material.

630,618. AUTOMATIC REGULATOR FOR ELECTRIC MOTORS; A. T. Marshall, Brockton, Mass. App. filed Aug. 29, 1898. This regulator is controlled by a thermostat acting to stop the contact arm at different relative positions.

630,634. PROTECTIVE CASING FOR ELECTRIC CABLES OR WIRES; A. Sundh, Yonkers, N. Y. App. filed March 28, 1899. The casing is made of coiled wires constructed in the form of a tube and having some of the coils disposed for tensile strength.

630,635. PROTECTIVE CASING FOR ELECTRIC CABLES OR WIRES; A. Sundh, Yonkers, N. Y. App. filed March 28, 1899. The casing consists of a spirally wound overlapping strip, the overlapping portions interlocking.

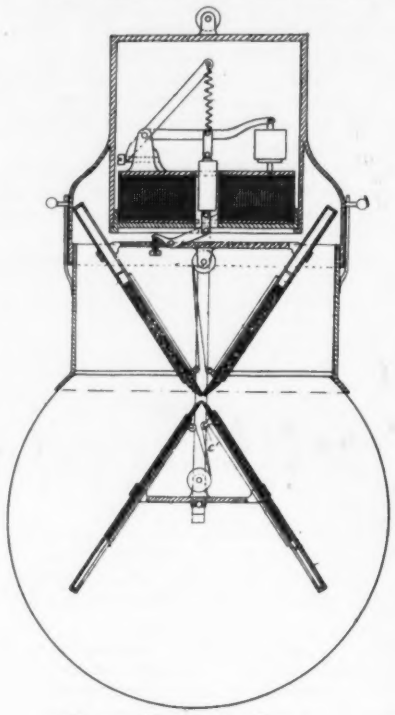
630,636. PROTECTIVE CASING FOR ELECTRIC CABLES OR WIRES; A. Sundh, Yonkers, N. Y. App. filed March 28, 1899. A modification of the preceding in which the overlapping edges of the strip have spurs and recesses, which accomplish the locking.

630,637. PROTECTIVE CASING FOR ELECTRIC CABLES OR WIRES; A. Sundh, Yonkers, N. Y. App. filed March 28, 1899. A modification of the preceding, in which there are two coiled strips, one inside of the other, the former being of longer pitch than the latter.

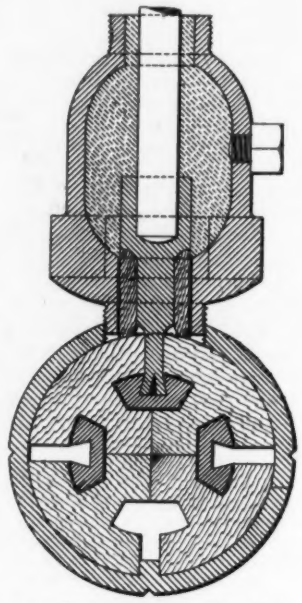
630,667. ELECTRIC SWITCH; H. H. Curtiss, Springfield, Mass. App. filed Nov. 5, 1898. This invention relates to specific improvements in what are known as the knife switch, the idea being to simplify and cheapen the manufacture.

630,671. ELECTRIC THERMOSTAT; L. H. Des Isles, Boston, Mass. App. filed Sept. 2, 1898. A cap covers a pair of contacts; in the centre of the cap a plug is held by fusible material; when the fuse melts a spring throws the plug against the contacts and closes the circuit.

630,697. ELECTRICAL CONDUCTING MAIN; J. S. Highfield and J. McKater, London, England. App. filed May 16, 1899. An underground electric conducting switch consisting of a series of dovetail grooved metal bars, each coated with suitable insulating material and having their dovetail



630,470.—Electric Arc Lamp.



630,697.—Electrical Conducting Main.

grooves facing outward, wooden bars arranged between the metal bars and their dovetail grooves, and a pipe enclosing the bars and having an external groove extending opposite the dovetail grooves of the metal bars.

630,714. STORAGE BATTERY; C. W. Kennedy, Rutledge, Pa. App. filed April 13, 1898. (See Current News and Notes.)

630,720. STORAGE BATTERY; C. and H. Lindenberger and W. B. Teal, Hannibal, Mo. App. filed March 1, 1899. (See Current News and Notes.)

630,753. STORAGE BATTERY; W. H. Smith, London, England. App. filed May 26, 1899. (See Current News and Notes.)

630,780. OVERHEAD TROLLEY; H. E. Loudemilch, Enders, Pa. App. filed Dec. 10, 1898. To prevent the wheel from slipping off the wire it has besides the central groove, shoulders arranged upon opposite sides thereof arranged in spiral or eccentric order and parallel with each other.

630,797. TELEPHONE; H. J. Blackwell, Jr., and M. A. Blackwell, New York, N. Y. App. filed Dec. 24, 1898. A pocket instrument intended for firemen and policemen and adapted to be attached to a fire alarm circuit without impairing the circuit for fire alarm purposes.

630,814. AUTOMATIC ELECTRIC GAS LIGHTING DEVICE; S. Meyer, New York. App. filed June 23, 1898. The key by which the gas is turned on is split into two parts and a portable bridge attached to a battery is to be grasped between the fingers and pressed upon the two parts of the key. This closes a circuit to the igniting device.

630,827. PRINTING TELEGRAPH; F. Hachmann, White Fish Bay, Wis. App. filed Oct. 27, 1898. The apparatus embodies a cylinder and type-wheel concentric therewith and fixed thereto and mounted in a frame, the type-wheel having type thereon, some characters of which exist in plurality, the cylinder being provided with pins corresponding in number with the type of the wheel, the pins standing for duplicate letters being arranged on the cylinder in the same diametrical plane, and keys one for each letter of the type-wheel arranged movably near to but insulated electrically from the cylinder and so as to be capable of being moved severally into the path of and so as to contact with a pin on the cylinder when the cylinder is revolved.

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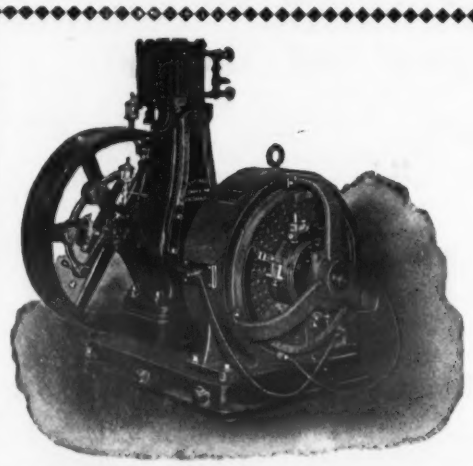

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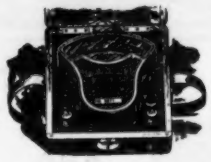

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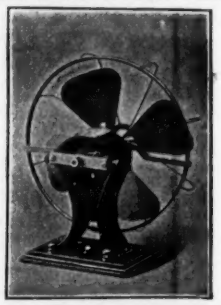

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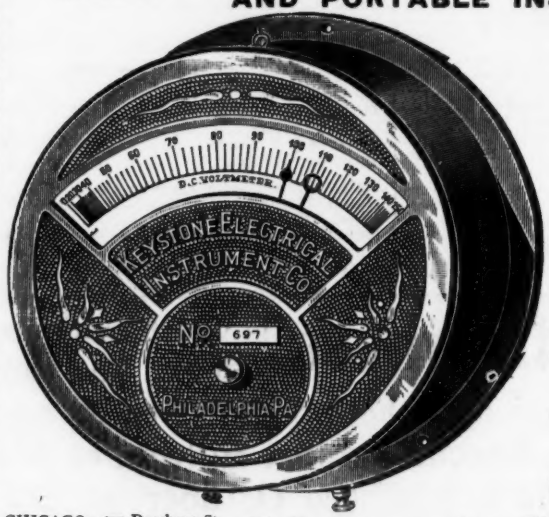

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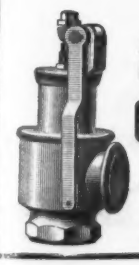

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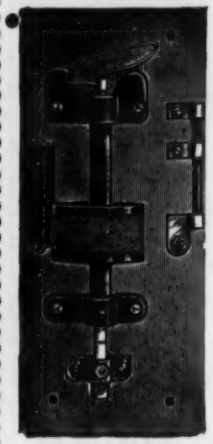

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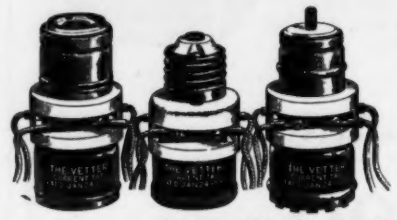

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